DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
BRANCH OF THE LIVE STOCK COMMISSIONER

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THE PRODUCTION OF BACON

FOR THE

BRITISH MARKET

Pamphlet.

BULLETIN No. 10
Revised and Enlarged

FISHER, Minister of Agriculture, Ottawa, Ont.
1907

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
BRANCH OF THE LIVE STOCK COMMISSIONER

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THE PRODUCTION OF BACON

FOR THE

BRITISH MARKET

BULLETIN No. 10
Revised and Enlarged

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

AUGUST, 1907

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OTTAWA, August 28, 1907.

To the Honourable
The Minister of Agriculture.

SIR :—

The demand for literature upon the bacon industry from the agricultural districts of Canada has been so extensive that the 20,000 issue of Bulletin No. 10, 'The Production of Bacon for the British Market' has become exhausted. In view of the importance of the hog-raising industry to the Canadian farmer and the weaknesses that still exist in the economical production of bacon hogs of good quality a new edition of the bulletin has been prepared. In its preparation the teaching has been brought up to date, an almost entirely new set of illustrations has been made and valuable new matter has been incorporated.

The comparatively insignificant number of hogs raised in many dairying sections suggested the need of information upon the economical use of skim milk and whey as a food for hogs. This edition contains valuable information upon whey and milk feeding, gathered from the experience of extensive users of these by-products.

The successful rearing of hogs, particularly winter and spring litters, depends to a great extent upon proper housing accommodation. The subject of housing is carefully dealt with in this edition in a discussion of shelter and exercise, and space is given to plans and descriptions of modern piggeries that are in successful operation in various localities and climates.

I herewith transmit copy for Bulletin No. 10, entitled 'The Production of Bacon for the British Market,' revised and enlarged by J. B. Spencer, B.S.A., and recommend that it be printed for distribution.

I have the honour to be, Sir,
Your obedient servant,

J. G. RUTHERFORD,
Live Stock Commissioner.

3906—1½

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I.—INTRODUCTION.

In securing data for this bulletin, the writer has drawn not only from personal experience and observation, but from every other reliable source of information within reach. Especial acknowledgment is due to Prof. G. E. Day, of the Ontario Agricultural College, Guelph, Ont., who has been freely consulted, also to representatives of leading Canadian packing companies. The work of the experiment stations of leading pork producing countries has been as far as possible carefully gone over, and such matter selected as was likely to be of value to Canadian farmers. In this part of the work the writer is much indebted to the very complete summary of the work of the experiment stations given in Prof. Henry's 'Feeds and Feeding.'

The great expansion of dairying in Canada during recent years has, as a natural sequence, brought about a corresponding increase in the swine rearing industry. It soon became evident that the Canadian farmer could not compete with the Americans in the production of the thick fat hog; which is a by-product, not of the cheese factories and dairy farms, but of the great corn fields of the middle, western and southern states. In these portions of the United States large numbers of pigs are reared on the blue grass and clover. They receive a little additional feed, which is usually corn, until they are of suitable age, when they follow the fattening cattle in the corn fields, in the proportion of four pigs to one bullock; these pigs pick up the ears that the cattle break down, and otherwise consume the waste. It is said by some feeders that the cost of production by this method does not exceed three cents per pound, but in this way only the thick, fat type of pig is produced—not the finer classes of bacon. It follows then that, while Canadians cannot compete in the production of the thick, fat pig the American feeders are not likely to produce the finer classes of bacon; even if they could, it is doubtful whether they would be willing to change their entire system of breeding and feeding to the extent that would be necessary to produce the Wiltshire sides and other fine grades. It became necessary, therefore, for Canadian packers to seek for a market, in which they would not be brought into direct competition with the cheap, though inferior product of the American corn fields. This they found in the English demand for prime, lean bacon in the form of the Wiltshire side. (See Fig. 5.) London is the centre of this market, which, although willing to pay liberal prices for suitable goods is exceedingly fastidious. This is a discriminating market for a fancy product, and the competition, which is practically limited to Canada, Denmark and Ireland, is not so much a matter of facilities for cheap production as of skill in the production of a high class article.

The class of hogs bred in Canada fifteen years ago was quite unsuited to the requirements of this trade, and the packers began to ask for a hog of a quite different conformation. Some enterprising breeders and some of our packers took steps to meet this demand by importing animals of the type that the British bacon curers pronounced the ideal one for their purpose. At first, the advent of breeds of the new type was not heartily welcomed. It is true that there was a pretty steady demand for them, but it was, in the beginning, the demand that always arises for something new, rather than the recognition of the value of these pigs to the country. Then again, there was the determined opposition of breeders of long established breeds to overcome, who could see no merit or usefulness in the new type of hog. Time, however, wrought wonderful changes, and now these same breeders are devoting their skill and energy with considerable success to the modification of their breeds to meet the requirements of the packer.

We are frequently asked, 'Why is it that the thick, fat hogs bring prices on the Chicago and other American markets almost equal to those received for lean singers? It is to a large extent the fresh pork trade in Chicago, Detroit, Cincinnati, Louisville,

Buffalo, New York and other large cities that maintains the price of pork. They have in the United States a very large foreign population, as well as a large negro population; these people prefer the thick, fat pork, and consume large quantities of it, and of lard. In Canada, on the other hand, our home trade is small. There is, it is true, a rapidly increasing consumption of hams and bacon in our towns and cities, but the demand is for mild-cured, lean, nicely marbled meat; just the class of goods required by our export trade. There is, in some country districts, and with an occasional customer in the city and town, still a demand for stout bacon, but over 90 per cent of the trade calls for meat that has been described as 'streaked,' meaning that the fat is freely intermixed with lean. The mining and lumber camps will buy and use large quantities of fat meat, but even here there is a growing demand for lighter and leaner goods, both as long clears and as barrelled pork. Recently a Canadian packing house had a large stock of long clears running from 35 lbs. to 50 lbs. average. A great deal of this went to the lumber camps and gave satisfaction. A provision dealer in Toronto told the writer that on account of this light bacon having gone to the lumbermen, they now wanted nothing else in many cases, as it suited their requirements exactly. The big, heavy fat sides that formerly found a ready market in the lumber camps, are now in many cases not wanted. Dealers say that it is difficult to sell these heavy sides, and that they must be sold at a low price in order to get rid of them. The lumber camps use a great deal of mess pork, which as a rule they buy in the United States, as it can generally be bought there at a lower price than Canadian packers can afford to put it up for, and this pork has the additional advantage that it can be carried for many months much better than long clears; so we suppose there will always be more or less of that cut wanted. Lumber shanties, the French population in Quebec, and the fishermen still call for a considerable quantity of fat meats. This trade, however, is growing smaller each succeeding year.

The province of British Columbia is an important market for hog products, calling altogether for the product of sizeable hogs with plenty of lean in it. A large part of the requirements of that province is supplied by the United States; this is because the price in Canada is often too high. Curers in the Western States are able to name prices that put the Eastern Canadian curers out of the market. This accounts for the important figures in the trade and navigation returns of imports of hog products into British Columbia.

The trade in Montreal, which uses a considerable quantity of fresh pork, as well as the large sausage and lard trade in that city, results in a quite important market there for heavy fat stock.

Though the greatest care may be taken by both our feeders and breeders to produce just what the markets require in the way of lean singers, there will always be more than enough of the heavy fat type to meet the demand.

Fig. 1.—Unfinished hogs (from 5 to 7 months old, weighing from 125 to 150 lbs. These animals are of good bacon type but have not had sufficient fattening food to properly finish them for the market.

Fig. 2.—Ideal hogs for the bacon trade (from 6 to 8 months old) weighing from 180 to 200 lbs. These animals have had sufficient freedom and healthful food to induce rapid growth followed by a short finishing period.

Fig. 3.—Hogs too short and fat for export trade, (from 7 to 9 months old) weighing from 200 to 250 lbs. These animals have been closely housed and fed an expensive ration which induced fattening rather than growth.

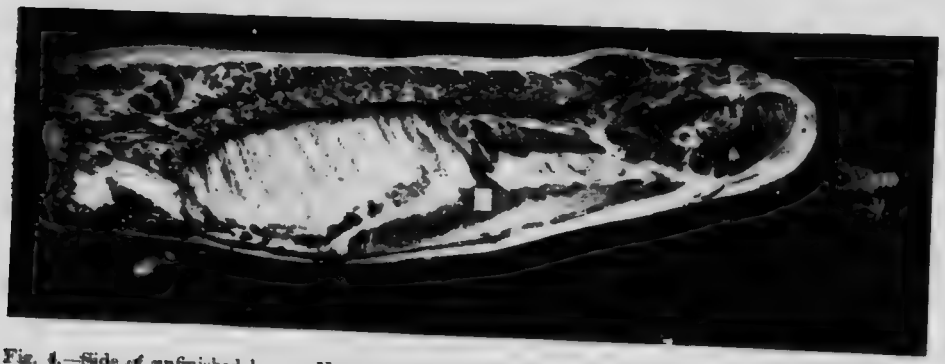

Fig. 4.—Side of unfinished hog. Note the undue leanness, also the shallowness of layer of fat—$\frac{3}{4}$ to 1 in.—along the back and thinness of cut on the lower side.

Fig. 5.—No. 1 Wiltshire Side. Note the even admixture of fat and lean meat, also the uniformity and depth of layer of fat—1½ to 2 in.—along the back from end to end of side.

Fig. 6.—Too thick and fat. Note the excessive depth of fat—2½ to 3 in.—along the back.

Fig. 7.—Carcass of a model hog.

Fig. 8.—A short, thick carcass. Hogs represented in Fig. 3 produce carcasses similar this.

Fig. 9.—A shipment as received at a Toronto packing house—about 85 per cent of these suitable for the British market.

Fig. 10.—A dozen selects.

Fig. 11.—A pair just right.

II.—THE STANDARD BACON TYPE.

Live stock must be judged from a two-fold standpoint:—

1. Its adaptability to the requirements of the market.

2. Its adaptability to the requirements of the producer, in constitution, nervous temperament and feeding qualities.

Happily, in our bacon industry the interests of the producer and consumer do not in any way conflict. It was for a time contended by many farmers that it costs more to produce the bacon hog than the animal of the thick fat type. The results obtained at our experiment stations supported by the experience of our most extensive and successful feeders have all gone to show that, if anything, the contrary is true. In an experiment by Prof. Day, at the Ontario Agricultural College, out of six groups of pigs, the groups scored first and third by the packer on the basis of their adaptability for the export trade, were first and second in economy of gain.

It cannot be denied that more skilful breeding and feeding is required to produce the bacon hog, but it does not necessarily require more food to produce a pound of gain than is required by hogs of other types.

The hog required for the production of the Wiltshire side is illustrated in Figs. 9, 10 and 11. In weight he should be not less than 170 lbs. nor more than 220 lbs., the most desirable weight being from 180 to 195 lbs., alive when fasted.

As will be seen, he is a smooth, trim, evenly developed pig, of great length, fair depth and moderate thickness. Described in detail, he should conform closely to the following:—

HEAD.

Snout should be for the breed moderately fine and of medium length. A very short stubby nose is usually associated with a short, thick body; on the other hand, a very long narrow snout, and head, like a long face on a steer, generally indicates poor feeding qualities.

Ears should be fine in texture, firmly attached, and alertly carried. A coarse and loosely carried ear indicates a sluggish temperament, delicate constitution and poor feeding qualities.

Eyes:—The eye is an excellent index of the health and also of the nervous temperament. Any departure from the normal in health and vigour will be indicated as quickly and surely by the eyes as by any other organ. A small, sunken, dull eye is an almost unfailing indication of a sluggish circulation and low vitality; a wild flashing eye indicates a nervous disposition that is highly undesirable; eyes of good size and prominent, bright but placid, indicate health, docility and good feeding qualities.

Jowl, light, trim and neat. A large flabbly jowl is objectionable, not only because it is of little value, but it is usually associated with excessive fat and flabbiness throughout.

Neck, of medium length, and showing no tendency to arch on top. A pig with an arching neck will cut too thick over the top of the shoulders. (See Fig. 8.)

FORE-QUARTERS.

Shoulders, light and smooth. They should be very compact on top, and no wider than the rest of the back. It is important that the shoulder blades be upright; it is

not enough that a pig be long from tip to tip, he must be long from shoulder blade to ham. Some apparently lengthy pigs will cut a short side of bacon, because of faulty conformation of the shoulder, the shoulder blades being too oblique and running back too far into the side.

Breast, of good width and full, indicating a large chest with plenty of room for vital organs. Sometimes the apparent width of the breast is increased by faulty attachment of the fore-legs, they being tacked on, so to speak, on the outside of the body. This conformation is always accompanied with a rough shoulder.

Fore-legs, set well apart without going to the extreme already spoken of, medium length and straight; pasterns strong, upright and moderately fine. The legs should be of fair length. Nature insists on preserving a certain measure of symmetry or co-relation of parts, and a short legged animal is usually a short bodied animal. It is hard to get them long and low; and since our aim is to breed for long sides, we must be willing to allow a corresponding length of leg. Excessively fine bone is usually associated with a tendency to fatten at the expense of growth, and this, of course, is fatal to the production of the Wiltshire side; on the other hand, very coarse bone is indicative of general grossness throughout, and is therefore undesirable.

BODY.

Back, of medium width, rising slightly above the straight line, and forming a slight arch from neck to tail. A sagging back indicates a lack of muscle or lean meat throughout. Note the excessive fat and lack of lean flesh or muscle down the back in Fig 6.

Sometimes a pig will show a drop in the back just behind the shoulder. This often indicates a weak constitution. The back should be nicely rounded from side to side and of medium width. A broad, flat back is usually associated with a short thick, chunky conformation throughout. On the other hand the ribs should not fall away too abruptly from the backbone, giving the formation known as a 'herring back.' A back of this description will, on cutting, be found to be bare and lacking in muscle or lean flesh.

Loin, should be strong and full, but not unduly arched. It should be of the same width as the rest of the back and well covered with flesh.

Side:—Since the side is the most valuable part of a bacon hog, it should be long, smooth, and filled out even with the shoulder and ham; it should be deep enough to provide for constitution, but not so deep as to give an excess of thin, flabby belly meat. See Figs. 2 and 11 and note length or side from shoulder to point of ham; note also the trim, firm belly and entire absence of flabbiness. Fig. 5 shows a Wiltshire side of the type that commands the highest price on the English market; contrast Fig. 5 with Fig. 3. The former are worth 50 cents per cwt. live weight more on the Canadian market than the latter. The first sells readily on the English market, while the other is almost unsaleable.

Heart-girth should be full, indicating constitution; the fore flank should be well let down and full behind the elbow. The packer would not object to a slightly tucked up appearance behind the fore-legs, but it is a fault that the breeder and feeder cannot afford to overlook. This is an opportune time to sound a note of warning to Canadian breeders. There is a noticeable tendency toward over-fineness with lack of vigour to be seen in many of our breeding herds. Judges at exhibitions are in part to blame for this. In too many cases undue stress is laid on smoothness of shoulder, length of side, shapeliness of ham, &c., while those features of the conformation that indicate constitution are apparently ignored. This is quite right in bacon classes; these should be judged wholly on their adaptability to the requirements of the consumer, but in judging breeding classes the interests of the producer must not be overlooked, or even be placed second to those of the consumer. Fortunately the two can be easily harmonized; the depth and fullness of the chest and fore-flank.

necessary to give room for the vital organs, do not imply roughness of shoulder, shortness of side, or paunchiness of belly, or in any other way detract from the value of the carcass.

Hind-flank, well let down and full, giving a straight underline, which should be markedly trim and neat, showing no flabbiness.

HIND-QUARTERS.

Rump, should be the same width as the back, of good length and dropping gradually from the loin to the tail, and nicely rounded over the top from side to side.

Ham, very trim and neat, tapering gradually to the hock, heavily muscled and firm. Any tendency to flabbiness or folds is very undesirable. Fig 7 shows an ideal ham hung up; note that it is medium in size and tapers evenly down to the hock.

Hind legs, firmly and squarely set with hocks tolerably well apart, but not bowed outward; the bone should be clean and moderately fine, and the pasterns upright and strong. They should be of medium length, as already mentioned in describing the forelegs: a very short leg usually indicates a short, compact conformation throughout, while excessive length of leg is often associated with poor feeding qualities.

Quality is a general term somewhat hard to define, but readily recognized by the experienced stockman. To say that a pig has lots of quality is to imply that his general appearance denotes good breeding; that he has a clean cut, trim, tidy, attractive appearance, with no sign of coarseness as indicated in the bone, skin and hair; that he is symmetrical, no part abnormally developed; and that he is active in his movements, but neither wild, cross nor restless.

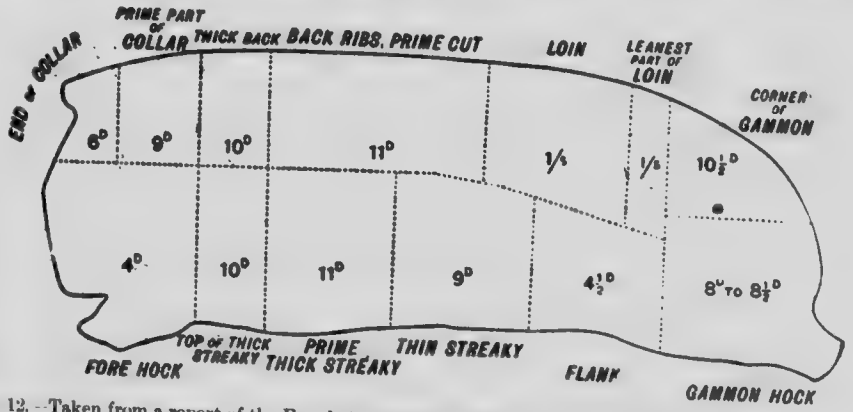

Fig. 12.—Taken from a report of the Royal Agricultural Society of England, shows the relative values on the English markets of the different cuts from a side of bacon. This cut explains the emphasis laid on length of side, and strength of back, especially of loin, in the foregoing discussion of the various points of conformation, but does not represent a model side.

SCORE CARDS.

'It is perhaps,' says Prof. Day, 'too much to expect that there will ever be entire unanimity of opinion among judges, yet it is something greatly to be desired, and all effort should be made to come as near to this desired end as possible. The main difficulty in judging seems to arise from the fact that judges differ regarding the relative importance of the various parts of an animal. They may be in entire accord as to what constitutes a perfect bacon hog, but unfortunately perfect animals are scarce, and it is in the attempt to balance one defect against another that differences in judgment frequently occur. It would seem reasonable, therefore, to assume that

some authoritative standard of excellence and scale of points would be helpful in bringing about hereafter uniformity in judging.

'There exists in the minds of some people a very strong prejudice against a scale of points, yet no judge worthy of the name ever makes awards in a show ring without a standard of excellence and scale of points in his mind. That is, he has his own ideas as to what constitutes perfection in the various parts of an animal, and he has also his own ideas as to the relative importance of these various parts. Without these things he cannot judge, for he has no basis on which to make awards. Yet the actual use of a score card in a show ring is to be condemned.

'Scoring animals is a useful practice for the student, training him to notice all points of the animal, forcing him to make up his mind whether defects are serious or otherwise, and guiding him as to the relative importance of parts, but all this should be learned before he attempts to act as judge.

'The scale of points, then, is merely a means towards an end. It is an aid to judgment. It can serve merely as a general guide to judges, and, properly used, will aid in securing uniformity.

'The preparation of a scale of points is no easy matter, and the scale presented here is not claimed to be perfection. It represents an effort to bring the question before the people in a tangible form, in the hope that something authoritative may result. In the scale of points given herewith an attempt has been made to distinguish between a breeding animal and one intended for slaughter. It is quite apparent that in breeding animals, weight limit should not be used. On the other hand, an animal that is to be slaughtered need not be criticised as to eyes, ears, hair, style or the strength of its pasterns, while weight becomes very important.'

SCALE OF POINTS FOR HOGS OF BACON TYPE.

Prepared by Prof. G. E. Day.

Head and Neck—8 points.

Snout, moderately fine	1
Eyes, good size, full and bright	1
Jowl, light and neat	3
Neck, medium length and rather light, with no tendency to arch on top	3

Fore-quarters—17 points.

Shoulders, light and smooth, rounded from side to side over top and very compact, no wider than back	9
Breast, good width and full	4
Fore-legs, set well apart, medium length, and straight, pasterns upright, bone flat, clean and moderately fine	4

Body—40 points.

Back, medium width, rising slightly above the straight line, and forming a very slight arch from neck to tail	9
Loin, strong and full but not unduly arched, wide as rest of back	5
Ribs, good length and moderately arched	3
Side, fairly deep, long, smooth and straight between shoulder and ham, a straight edge laid over shoulder point and ham should touch the side throughout	12
Heart-girth, full, but not flabby at fore flanks, filled out even with side of shoulder; there should be no tucked up appearance back of fore legs, nor droop back of shoulder top	5
Flank, full and low	1
Underline, straight; the belly should be markedly trim and neat	5

Hind-quarters—15 points.

Rump, same width as back, long and slightly rounded from a point above hips to tail, and rounded from side to side over top. 5

Ham, full without flabbiness; thigh tapering towards hock carrying flesh well down towards hock. 6

Hind legs, medium length; hocks set well apart but not bowed outward; bone clean and moderately fine; pasterns strong. 4

Quality—15 points.

Ear, rather thin, firm and of medium size (1); hair fine and abundant (2); skin, smooth, showing no tendency to wrinkle (3); bone, clean in legs, and top of shoulder (4); flesh, firm and smooth, with no flabbiness at moderately fine in snout and head, and showing no prominence on side jowl, fore flank, belly or ham (5). 15

Style—5 points.

Active in movement, walking without a swaying motion and standing well up on pasterns. 5

Perfection. 100

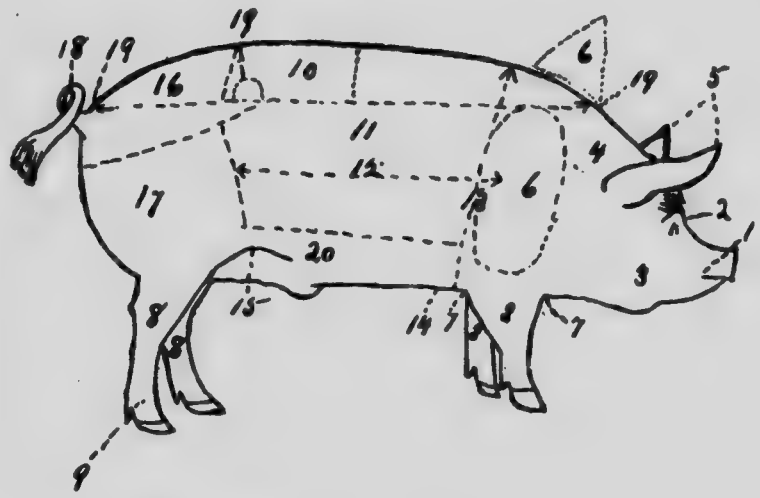

Diagram showing Location of Points of the Hog.

1. Snout.
2. Face.
3. Jowl.
4. Neck.
5. Ears.
6. Shoulder.
7. Chest.
8. Leg.
9. Pastern
10. Loin.
11. Ribs.
12. Side.
13. Girth.
14. Fore-Flank.
15. Hind-Flank.
16. Rump.
17. Ham.
18. Tail.
19. Back.
20. Belly.

III.—UNDESIRABLE HOGS FOR BACON PRODUCTION.

There are a number of classes of undesirable hogs being marketed for bacon at all seasons of the year. These include unfinished, overfat, prematurely finished hogs, and sows that have been used for breeding purposes. Of these the unfinished animals are most objectionable, and during the season of 1907 have been marketed in numbers out of all proportion to what they should be.

UNFINISHED HOGS.

According to reports from a number of the large packing companies, the proportion of unfinished hogs is much too large, running at times as high as fifteen per cent of the total receipts at packing houses in Central Ontario, twenty per cent in Eastern Ontario and Quebec, and about fifteen per cent in Western Ontario. This is a very serious matter from the standpoint of all concerned, as such pigs dress poorly, giving a low percentage of carcass, and they make such inferior meat that the reputation of Canadian bacon stands in danger of serious injury if the present proportion of these pigs continues to go forward as bacon.

Why hog raisers persist in sending this unfinished stuff to market is not easy to understand, unless it is the comparatively high price of coarse grains which are necessary in finishing these animals, and perhaps in some cases a fear that the high values for hogs which have prevailed for some time would suddenly drop. These, however, are not valid reasons when the injury such animals do the trade is considered. The 'grass' or unfinished hog is a serious menace to the bacon industry, and the time has come when the farmers, the buyers and the packers ought to co-operate against him.

One of the leading Canadian pork packers and exporters, speaking of the objections to the unfinished hog, says: "He won't make good bacon; he is an unprofitable hog to ship alive, an unprofitable hog to slaughter, and when he is made into bacon it is thin and tough and has to be sold at a heavy reduction on select goods.' Another packer says: 'The thin unfinished hog is not a bacon producer at all, and should be kept back and fed up until it weighs not less than 180 lbs. When thin sides are converted into bacon they invariably cause trouble as well as direct monetary loss.' Still another packer expresses his views upon the light hog. He says: 'The chief objection to unfinished hogs for bacon is that they shrink in killing about 5 to 8 per cent more than when they are finished, which, consequently, makes the bacon so much dearer; and in the Old Country they do not want sides weighing less than 50 pounds, which means that the hog must be at least 160 pounds and in good flesh in order to produce 50-pound sides; anything below 160 pounds makes bacon which is undesirable and hard to sell.'

In England the buyers refer to the bacon from thin hogs as 'skin and misery.' Some of them have become very emphatic in their denunciation of it, stating that the bacon trade has already received serious injury from it, and the sooner it is stopped from being sent over the better it will be for the trade; if it continues to be sent as it has been for the past few months the trade will soon cease to exist. A hog that is too thin to make bacon of a desirable weight and quality is similar to any other inferior product inasmuch as it lowers the value of the better goods and seriously injures the trade to which it belongs.

Fig. 1 fairly well represents the class of hogs known as unfinished; these animals are of a good type for bacon production, but they are in only field condition. Fig. 4 shows a side of a thin pig.

OVER-FAT HOGS.

Notwithstanding the fact that the over-fat hog has been preached against for years by those interested in the development of the high-class bacon trade, and the fact that the price paid for these animals is frequently cut to the extent of one-quarter of a cent to one-half cent per pound for the live hog, the supply of overdone animals continues much too great, more especially during the late fall and winter season. The demand for the pork from such animals is becoming less and less, and as a rule the bacon from such hogs will have to be sold at say an average of five shillings per 112 pounds less than prime lean. Why these animals are kept so long at the trough is a mystery unless it is to catch an improved market. It seems to be an overlooked fact that the last few pounds of an overfat hog are produced at a much greater relative cost than the same number of pounds added to an animal approaching the finished condition. It is therefore clear that a feeder who holds his hogs beyond the finished stage does so at a loss even though he receives an advance in price and is not docked for over-fatness—results not often secured by holding. There is no doubt that these hogs rob the feeder. Feeding experiments have shown that hogs do not give good returns for food consumed after they have passed the finished condition. (See table under 'Cost of Gain and Different Stages of Growth,' page)

The marketing of hogs that exceed 220 pounds live weight should be discouraged for the production of bacon, as such causes loss both to the producer and the packer. Fig. 3 represents the over-fat hog, while Fig. 6 shows the class of side he produces.

PREMATURELY FINISHED HOGS.

Another class of undesirable hogs for the production of fine bacon is the prematurely finished pigs weighing from 145 to 160 pounds live weight. These are doing much to injure the reputation of Canadian bacon. As a rule, the animals of this class are pleasing to the eye, they kill out a high proportion of meat to the carcass and they satisfy the palate of the consumer, especially when eaten fresh, but when made into bacon they do not fill the requirements of the market. The size is objectionable to the buyers, packers tell us that this class of goods cannot be sold at a profit on the London market. For this reason it is decidedly unwise to force hogs along to the finished state that have not had time to attain a weight of at least 180 pounds.

There is a demand for bacon made from these light well finished pigs, but it is so limited that there is always danger of an over supply, when the price is sure to fall several shillings per cwt. and the stock becomes a drag on the market. The pig of this class is not the fault of the breed to which it belongs, nor the character of the animal, but rather to the over-generosity of the feeder who has kept his charge confined in close quarters and forced it along from an early age to the finished animal of short dimensions and insufficient weight at from four to five months old.

SOWS.

Too many of the cargoes of hogs that arrive at the packing houses contain more or less of sows that have reared one or more litters of pigs. These can rarely be used as bacon producers; the great majority are not bacon animals and never should be sent to market in 'bacon' condition. As a rule, those that are not too heavy are too thin in flesh, and therefore may be classed as unfinished; and those that are well enough fleshed are too heavy to yield sides suitable for the bacon trade. The presence of so many of these sows in shipments of bacon hogs is largely due to the too common but unwise practice of turning off sows while still young instead of allowing those that are promising to remain in the herd as matrons for a number of years, making good mothers of large litters. And it is true that some first litters turn out to be

well-doing, vigorous animals, the great bulk of them are not so strong as litters from older sows. To continue to breed only from these immature sows, turning them off after the first litter, is to perpetuate weakness rather than strength in the individuals of the herd, which will in time show itself in a race of swine that are not good thrivers and are prone to ailments and weaknesses that will seriously interfere with profit-making in pig rearing. To market young brood sows in medium flesh is to injure the bacon industry both directly and indirectly—directly in lowering the average quality of our bacon, and indirectly in weakening the constitution of our bacon herds.

The question will arise, what is to be done with the animals that have outlived their profitable usefulness in the breeding herd. It has been shown that it is not in the interest of the industry to turn them off as bacon animals. It is the animals of this class that may be depended upon to supply the heavy pork and lard trade, and for this purpose they should be made thick fat. How to make them so at a profit is a question of importance. A thin sow placed in a pen and fed almost exclusively on grain will, in all probability, 'eat her head off' before she is thick fat, but there are better ways of fattening such an animal. The diet of an old sow or 'stag' should be composed largely of such cheap foods as mangels and sugar beets if in season, or pasture crops such as clover, alfalfa, rape, &c.; a vigorous sow or stag getting an abundance of any of these foods will gain rapidly and if given a moderate grain ration will soon be fat for the market.

The best time to place a thin sow in the 'feed lot' is in the early summer after her spring litter has been weaned and she has dried off. If turned on a luxuriant pasture and given a small grain ration, gradually increasing it, she will, as a rule, in from eight to twelve weeks be fat enough to meet the requirements of the market. While the gains made by such an animal have cost high per cwt., it should be remembered that she has given a profit many times over as a mother, and it is the last hundred or two of gain that renders her entire carcass of marketable value.

Fig. 13.—Berkshire Sow.

Fig. 14.—Yorkshire Sow.

Fig. 15.—A group of Tamworth Sows.

Fig. 16. - Berkshire Boar.

Fig. 17.—Yorkshire Boar.

Fig. 18.—Tamworth Boar.

IV.—BREEDS AND BREEDING.

Since the pork packers are in closest touch with the British consumer, they are the most competent judges of the class of hogs required for the most profitable trade; and we find that they recommend the use of Yorkshires and Tamworths as especially suitable for the production of bacon hogs, while Berkshires of the newest type are excellent. The other breeds are not, as yet, so well adapted, but, as has been already stated, the breeders of these breeds are rapidly bringing their pigs into line, and sows of these kinds when crossed with males of the more approved bacon type, produce good bacon pigs. These cross-bred pigs frequently make more economical gains than the pure breds. The Yorkshire-Berkshire and Tamworth-Berkshire cross is especially popular.

No breed or combination of breeds has a monopoly of all the desirable qualities in a pig. 'There are good and bad in all breeds, and bad and worse in some.' It does not follow that because a hog is of any given breeding he is necessarily a good or a bad bacon hog. It is necessary, therefore, that the breeder of market hogs has a clear-cut conception of the ideal pig; then he will be in a position to make the best of the materials at his disposal by judicious selection and careful breeding.

SELECTION OF THE SOW.

Care should be taken in selecting the females of the herd to choose only those of a quiet, contented temperament. Few things are more exasperating than a roving, noisy, discontented sow; not only is she a continual menace to fences and gates, but she is cross at farrowing time, and is quite as likely as not to destroy half of her litter in a fit of nervous excitement. In addition to this, a sow of this description is seldom or never a good milker, and every stockman knows that the profit or loss on a batch of pigs is determined largely by the start they get in life during the first six or eight weeks. The milking qualities of the sow is a matter too often overlooked or ignored when selecting the females for a breeding herd. Many men seem to take it for granted that if they can get a sow to produce a large litter, she will, as a matter of course, nourish them afterwards. This is a grave mistake. Sows vary in their milking propensities as widely as the cows in an unselected herd. Among pigs the ability to give a large flow of milk is more a family trait than a breed characteristic; that is to say, different families of the same breed differ more in this particular than do the different breeds. It is, therefore, largely a matter of selection. A well formed udder is, of course, essential. There should be not fewer than twelve, better fourteen, well developed, evenly placed teats, extending well up to the forelegs.

The sow should be large and roomy, with great length and depth of side; she must, however, be trim and neat in her outlines, showing no tendency to bagginess or flabbiness, and, though not wild or nervous, she must be active in her movements. An animal having a heavy, listless, clumsy walk should not be retained in a breeding herd. This indicates a lack of vital force; and an animal with this characteristic is not likely to be so prepotent as one with a more active, sprightly temperament.

The brood sow should be selected from prolific families. A sow must raise a given number of pigs each year to pay expenses, and each additional pig represents a profit. There is, however, a limit to the number of pigs in a profitable litter; very large litters are apt to be weak and uneven in quality. Few sows can properly nourish more than fourteen pigs, and an even litter of from eight to twelve large, strong, lusty fellows is more profitable than a litter of sixteen or eighteen weak, flabby and ill-nourished pigs.

SELECTION OF THE SIRE.

The choice of the sire is perhaps the most important step in all breeding operations. The trite remark that 'the sire is half the herd' is only part of the truth. He is much more than half of the herd because, of the two parents, he usually exerts the greater influence on the conformation of the offspring. This, of course, is true only when he is the more intensely bred. It is not enough that he be pure-bred, it is important that he come of a line of ancestry, on both the male and the female side, that are remarkable for uniformity and individual merit. If he be the chance result of a line of indiscriminate breeding, he is not likely to prove an impressive sire. His stock can scarcely fail to be irregular in type. This point cannot well be over-emphasized, for it is just here that the novice in breeding is most apt to make mistakes. It is a too common practice to select and buy breeding stock from among the winners at our exhibitions, taking care only to stipulate that they be eligible for registration. Frequently a phenomenal show yard animal is an accident of birth, and, even though he be registered in the herd book, is none the less a 'scrub' in point of breeding, and can reproduce his good qualities only by accident. It is unfortunately true that a certificate of registration is not always a certificate of merit. The only safe way to select breeding stock is to visit the long established herd of some breeder of repute and buy after seeing the sire and dam, and if possible, the grand-sire and grand-dam of the animal selected. Choose a boar from a large, even litter; fecundity is an hereditary trait and is essential to profitable hog raising, and the evenness of the litter is a valuable guaranty of the excellence of his breeding and of his consequent prepotency.

The offspring of immature parents should seldom or never be used for breeding purposes. They are apt to lack in constitution and vigour; this is especially the case in the offspring of an immature dam. Few things will more quickly and surely deteriorate a herd in size, vigour and fecundity than the continued use of immature females.

In conformation the boar not only must be of the approved bacon type, but must have that distinct and unmistakable masculinity of appearance - easily recognized but not easily described. Masculnity does not necessarily imply undue coarseness; it consists rather in a bold, fearless 'come on, who's afraid,' expression of countenance than in any peculiarity of conformation. A certain amount of coarseness is unavoidable, especially in an aged boar; but he must not have such excessive roughness as would indicate poor feeding qualities. Nor is it desirable that he be of extreme size. Mr. Sanders Spencer, the noted English breeder, says on this point: 'Although some persons make mere size a great point when choosing a boar, our experience leads us to consider this to be a mistake; a very large boar seldom lasts long; he becomes too heavy for the sows; he probably proves to be slow and his litters few and small in number. A very large and heavy boar is also more likely to suffer from weakness of the spine or hind quarters, and is frequently weak in his joints and crooked in his legs. These latter failings especially should be avoided, as they are hereditary, and will frequently crop up for several generations. Weakness of ankle and roundness of bone, two qualities which should be avoided in a sire, are often allied with great size. A medium size, compact boar, heavy in the hind-quarters and light in the fore-quarters will frequently continue fruitful for at least twice as long as will the heavy shouldered and coarse boned boar. Nearly all of the most successful pigs have been on a small rather than a large scale.'

V.—CARE OF BREEDING ANIMALS.

THE BOAR.

Assuming that the pig has been purchased shortly after weaning, he should be placed in a dry, clean, roomy pen with access at will to a paddock. It is well to give him a barrow of about his own age for company; feed liberally on food calculated to form bone and muscle but do not force him too rapidly; care must be taken to avoid getting him too fat. No better food can be given than the by-products of the dairy with middlings or ground oats supplemented with plenty of succulent food in the form of grass or roots. Let him root in the paddock; it is the best exercise he can take, calling into active play every muscle in the body, and, besides, it furnishes him with amusement and occupation. Curry and brush him frequently; it not only keeps his skin and hair healthy and active, but tends to make him quiet and gentle. The tusks should be removed as soon as well formed.

THE SOW.

Breeding sows should not be closely confined summer or winter, but should be given the run of a pasture in summer and of a large yard in winter. If there is one mistake more common than another in the management of the breeding herd it is the failure to provide for and compel the hog to take sufficient exercise. The hog is by nature a grazing animal, and exercise is essential to his welfare. If the sows can be given the run of a pasture during the summer and of the stubble in autumn they will require little else to keep them in excellent breeding condition. They must, of course, have water and shelter; if they have access to a running stream in which they may wallow so much the better. A mud bath is nature's method of keeping a hog's skin healthy and free from vermin. Shelter is best provided by the use of a portable pen.

In winter they should have the run of the barnyard, a dry sheltered spot being provided for them to sleep in. A portable pen serves the purpose admirably. It is better not to be too warm so long as it is dry, free from drafts, well supplied with straw in which they may huddle. If their sleeping quarters are made too warm they chill too quickly on going out into the yard and they will not voluntarily take enough exercise.

They should be fed on nutritious but not too concentrated food. Mature, thrifty sows can be maintained in excellent breeding condition on a ration consisting largely of roots, preferably mangels or sugar beets. During a very cold snap some grain should be given to assist in maintaining the animal heat. As the sows become farther advanced in the period of gestation it is necessary to give more nourishment in less bulk, therefore the allowance of mangels should be gradually decreased and the complement of grain correspondingly increased as the season advances. The grain used should be of a flesh-forming rather than of a fat or heat-producing character. Shorts, or middlings, is excellent, so is ground oats; barley or corn should be used sparingly, unless diluted with some form of dairy by-product. If fed alone these grains are too 'heating' in their effect on the system. Sows wintered in this way should not be given thin sloppy food; the meal fed should have just enough water or milk poured over it to moisten it well. They will get enough water in the roots fed to supply all the requirements of the system; and to compel them to take water in excess of that amount, especially in cold weather, is to impose an unnecessary tax on the constitution. The energy required to warm up and throw off from the system a surplus of water, which some feeders compel their hogs to take in the form of thin sloppy food, is an unwarranted waste that not many can afford.

The objective point to be aimed at in the wintering of brood sows is to nourish and care for them in such a way that the spring litters will consist of good sized, well nourished, healthy, vigorous pigs, and that the sows themselves will be in such a condition of flesh as will carry them well over the trying period of nursing. To do this, the sows must have plenty of exercise, and must be fleshy but not fat. Sows carrying a load of soft, flabby fat put on in close pens will drop undersized and delicate pigs and they themselves will fail rapidly during the milking period. In addition to this, sows kept closely confined and fed largely on grain are apt to have their digestive systems so deranged as to develop abnormal appetites, and at farrowing time are as likely as not to devour a portion if not all of their offspring. On the contrary, experience has shown that the system of wintering previously recommended in which the sows are given abundant exercise and fed on a nourishing but cooling succulent ration, has invariably been followed with the most satisfactory results.

A week or ten days before farrowing the sow should be placed in the breeding pen, in order that she may become reconciled to her new surroundings before the critical time arrives. It is also important that the attendant get on good terms with the sow; a few minutes spent on her every day with a stiff brush will be a good investment of time. This 'currying favour' with the sow should not, of course, be a mere spasmodic effort at each farrowing period, it is the habitual practice of the thorough-going and successful stockman.

The breeding pen should not be too large; about eight feet square. If the pen is too large, there is danger in cold weather of the newly farrowed pigs wandering away from the dam, getting lost and perishing from the cold. The pen should be warm and dry, and furnished with a fender to prevent the dam overlying her young. This consists of a plank or pole placed all around the sides of the pen about ten inches from the wall and eight inches from the floor. Very little bedding should be used, and this should be chaff or cut straw. If a large quantity of long straw is used the youngsters are apt to get tangled up in it and be overlaid by the sow.

An hour or so after farrowing the sow should be given a drink of warm water into which not more than a handful or two of shorts or meal has been stirred. Very little grain should be given the first day; overfeeding with grain during the few days immediately before and after farrowing is apt to derange the digestive system and also cause trouble with the udder. The feed should be gradually increased until at the end of the first week she is getting all she will eat up clean. Nursing sows should be liberally fed on a ration well adapted to milk production. A sow nursing a large litter is subjected to a very severe strain, and if she be a good milker will fall away rapidly in flesh in spite of the most skilful feeding. This, however, is no reflector on the sow; for at no other period in the life of the pig is gain more economically obtained than while sucking its dam. Dairy by-products are especially valuable at this time, and of the grains, shorts or chopped oats are among the best. Barley and corn meal are too heating; the former tends to dry a sow off.

While some variety should be introduced into the sow's ration, extreme or radical changes must be avoided, as this is likely to cause digestive troubles in both dam and offspring.

The sow and her litter should be fed in a wide, flat-bottomed trough so large that when the food is put in it will cover the bottom not more than one inch deep. The young of most animals learn best by imitation, especially of the dam, and if a trough of this kind is used into which the pigs can climb they will quickly learn to eat much more so than by the plan, so popular with some, of arranging a separate trough for them, from which the sow is excluded. After the young pigs have learned to eat well they may then be given access to separate feeding pens.

In cold weather, the food for the nursing sows should be given warm, and not too sloppy, water being supplied separately. It is also important that both sow and litter have frequent access to earth; it is easily possible to ruin the digestive system of a pig even before it is removed from the dam, and there is perhaps no better corrective for hogs than soil. In cold weather it must be furnished by artificial means.

It is an excellent plan to l[illegible] a supply in the fall for winter use, by piling up a few sods in some place where they will not freeze and can be readily obtained when wanted. These are better if taken from the woods, or some other location where the soil contains a large percentage of humus or decayed vegetable matter. Failing this, a pailful of earth from the root cellar twice a week will serve the purpose very well.

The litter should be weaned when eight or ten weeks old; by that time they should be eating so well at the trough that they will scarcely miss their dam when she is removed. The whole litter should be removed at once, letting them back to the sow once or twice if necessary, at intervals of not more than 10 hours, to relieve her udder. It is quite a common practice to leave one or two pigs with the dam for a few days for this purpose. This is a mistake, because each pig will suck only the teat to which he has been accustomed, and will not touch the others, in this way defeating the object for which he was left with the dam.

Sometimes the milk teeth are abnormally long and sharp, causing them to irritate the sow's udder and lacerate the gums and tongue of the pig. They frequently become discoloured from digestive troubles, and are then known as 'black teeth.' They should be removed with a pair of pincers as soon as noticed. Many breeders make it a practice to remove them from the whole litter when two or three days old; and, although not always necessary, this is, perhaps, the better plan.

VI.—HOUSING.

Much of the success of hog-raising depends upon suitable housing. Suitable housing does not, however, demand expensively built houses and pens designed so as to provide summer temperature during the winter season. In an ambitious desire to treat swine with due consideration for their comfort many progressive hog raisers have, during the past few years, practically wasted large sums of money in building elaborate warm houses for their herds. Having wintered their stock of all ages and conditions in these structures for one or two seasons the mistake they had made became apparent by reason of the fact that the swine instead of showing greater vigour, exhibited signs of ill-health in the form of coughing, lameness, scurfiness of skin and other evidences of lack of thrift. The chief difficulty from these close houses is due to the lack of exercise taken by the swine kept in them. After rising from their comfortable beds to take their food, which is usually provided regularly, near at hand and in palatable condition, the pigs fill themselves and again return to their resting places. This mode of living followed for weeks and months at a season of year when outdoor life is uninviting, even should the pen door be left open, is attended with indigestion, constipation and other forms of sluggishness, causing weak litters, lack of a good milk flow in dams, stunted weanlings and slow gains in older hogs. Exercise is one essential for swine of all ages if hog raising is to be made a success, and it is in not providing this that the warm pen used for both sleeping and feeding fails. For young litters coming in cold weather a warm pen is necessary, and rather close quarters are also conducive to the most profitable gains during a hog's final fattening period, but at no other time in a hog's life is close housing advantageous.

For brood sows due to farrow in the late winter or early spring months there is no better shelter than the movable cabin. A number of these can be ranged side by side in or near the barn yard. If kept comfortably bedded four or five large sows will lie very comfortably in a cabin constructed according to directions given further on. The old style of rail creep beneath a straw stack, so long as it is closed on three sides, affords a fine bed for breeding sows or even growing pigs. On some of the most extensive hog breeding establishments the only shelter given the sows in winter is an old barn or shed, lined up to keep the draughts out, and having a constantly open door which affords free and unlimited access to the open air. The feeding is done in the open, which compels the herd to take a good amount of daily exercise, upon which good health so much depends. Sows thus housed and fed on food composed of pulped roots and chopped grain, bran, &c., given in a rather dry consistency, will maintain a fine condition for successful motherhood.

PLAN AND DESCRIPTION OF MOVABLE PEN.

The movable pen shown in the accompanying illustration is adaptable to various requirements. It may be used as a shade in summer and a protection from the cold in winter. As a summer pen it should be set in a dry location where the air may circulate freely about it. In summer these pens should be placed in the hog pasture; much better results being obtained if the pasture is a large rather than a small field. As a winter house it should have a sheltered location, preferably close to the barn yard.

A pen made of single inch lumber does admirably if well made and all cracks are carefully battened. The battens should be at least three inches wide and these securely nailed on, the nails being clinched on the inside to guard against warping.

Whether for summer or winter use a floor is necessary, both for the comfort of the animals and the strength of the pen. Two-inch planking nailed on 4 by 4-inch cedar sills is desirable for the floor. The ends of the sills are shown in Fig. B. It is well to round off the lower angles of the sills, making them into runners for moving the pen from place to place. A ring or a U clevis may be fastened to the front or back end of each of the outside sills.

Figures B and C show a form and size of doorway that answers very well for the hogs to go in and out, but it is not large enough for an attendant to enter with comfort. It is well to have a doorway at least five feet high. The door should be cut in half so that the upper part may be kept closed when not in use. Many hog raisers hang the lower to the upper half in such a way that the former swings in and out as the hogs enter or leave the pen. In summer the lower door may be hooked up out of the way. On severe winter nights the door may be protected by a heavy curtain or a bank of strawy manure to keep out cold draughts, which are always detrimental to a hog's welfare.

A pen arranged for cold weather requires a window in the front (south end) to admit the sun's rays. This may be placed in the upper half of the door or above it.

A pen requires an opening for ventilation, Some recommend a hole 3 or 4 inches across at the back, close up to the peak; another form is shown in Fig. B, and still another in Fig. D, which is perhaps the best.

An 8-ft. pen requires about 200 feet of lumber. Sixteen feet boards are best to use, as these cut without waste. This pen would also require 56 feet of scantling for sills, and 64 feet of planking for flooring.

A pen of these dimensions will accommodate from 8 to 10 growing pigs or a sow and litter.

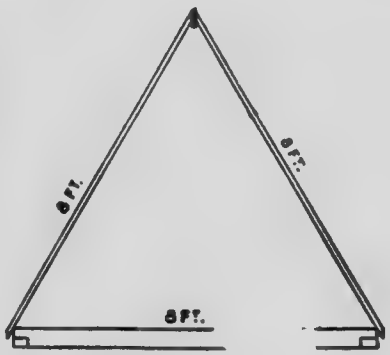

Fig. A.—Showing sills made of 4 x 4 inch scantling, and slope of roof. Two 4 x 4 inch scantlings 16 feet long, make the sills.

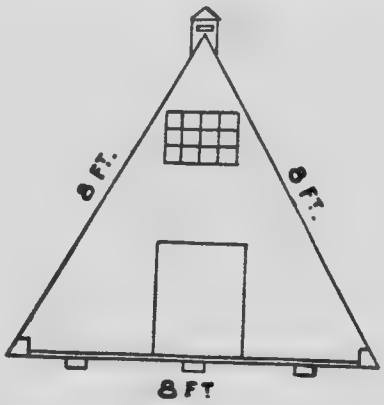

Fig. B.—Front view of portable hog pen, where three scantlings are used as sills.

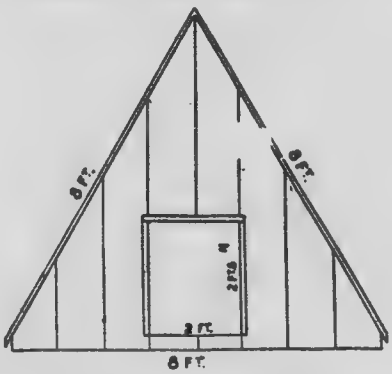

Fig. C.—Front view of Fig. A.

Fig. D.—Showing a method of arranging ridge boards to afford ventilation when pen is intended to have doors closed.

Fig. 19.—The portable pen.

THE LARGE PIGGERY.

Since every farm upon which swine are raised must have a hog pen of greater or less dimensions, the most important considerations that enter into the construction of a modern piggery will be dealt with. The chief qualifications of a piggery are dryness, ventilation, freedom from draughts, light, reasonable warmth and convenience. Of these, dryness, which is largely governed by ventilation, is of first importance. Masonry walls and floors have been used in a number of expensively constructed pens, but these are usually cold, comfortless and damp during the winter season. Without doubt wooden walls constructed in such a way as to provide for a complete dead air space in the centre are the best. A very satisfactory wall is made by setting 2 by 4 inch scantlings on end and boarding inside and out with rough lumber. Both inside and outside should then be covered with tar paper well lapped at the joints and then closely boarded up with matched lumber. A very suitable outside covering would consist of clapboards or lumber of good quality nailed on perpendicular and having the cracks battened. The inside tier of boards should consist of matched lumber. A tight or a closed ceiling is frequently a wet and even dripping one, or is coated with frost, in very cold weather, and this is usually attended with dire results for the pigs.

Probably the most satisfactory ceiling at the present time is one constructed of boards or poles separated at such a distance as to be easily pervious to the atmosphere. This, when covered several feet deep with straw, provides perhaps the most suitable style of ventilation, and therefore the driest pen that may be secured without artificial heat.

A number of extensive hog breeders in the country have resorted to the use of artificial heat in their hog pens. This is provided, not so much for the sake of the heat for the animals, but for the cooking of foods. The escaping steam from the cooker should not be allowed to escape into the hog pen on account of the moisture that it would deposit in the building. Where such a system of heating is installed the question of ventilation is very easily solved, and the pen is usually comfortably dry. Artificial warmth, however, for any class of live stock, has its disadvantages in rendering the animals kept within its influence subject to colds and lack of vigour. Where only a small number of sows are kept there is no better pen for farrowing sows in cold weather than a box stall in a cattle stable, which seems to possess a warmth and condition of atmosphere suitable to the young things.

The question of light is receiving much greater attention than it did years ago. Every pen where swine are kept, more particularly in the winter season, should have an abundance of sunlight. To get this a large proportion of the wall on the east, south and west sides should consist of windows, which should be made double and very close in order to conserve the warmth of the pen.

There is no better material for a hog pen floor than cement concrete. This, however, is not a suitable material for the hogs to lie upon as it is usually cold and in many cases damp, even though large quantities of bedding are used. An elevated sleeping pen, whether it be a platform some three or four inches above the floor, or elevated sufficiently high to allow the pigs to run underneath, is quite popular throughout the country. The 'upstairs' plan has the disadvantage of shutting out light to some extent, but the advantage of providing a large additional floor space for the animals. Where the pen is of good size the lower sleeping platform is perhaps to be preferred. When this platform is limited in space to little more than is sufficient for the hogs to lie comfortably there is little or no probability of the bedding being dampened or soiled in any way by the hogs.

For the guidance of hog raisers who wish to build large piggeries, three styles of buildings have been selected for description. Each has been used sufficiently to prove its suitability from the standpoint of the hogs, the owner and the attendant.

Fig. 20.--Each yard provided with a cabin.

Fig. 21.—Piggery on Stadacona Farm, Cap Rouge, Quebec.

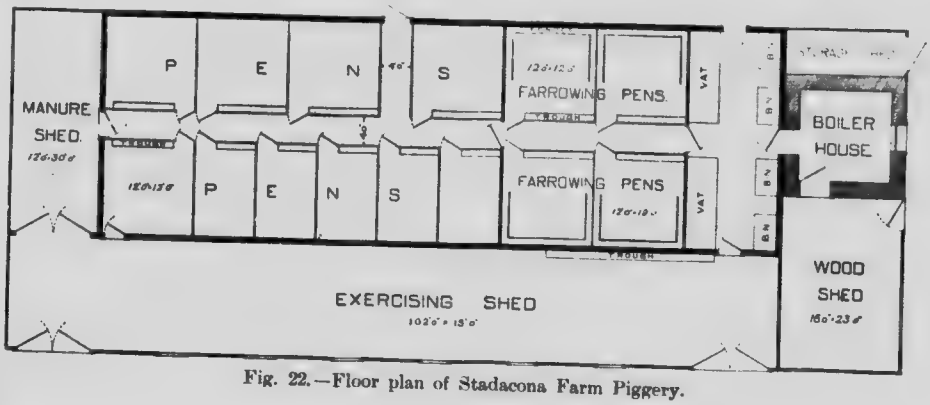

Fig. 22.—Floor plan of Stadacona Farm Piggery.

Fig. 23. Piggery at the Manitoba Agricultural College.—South Side.

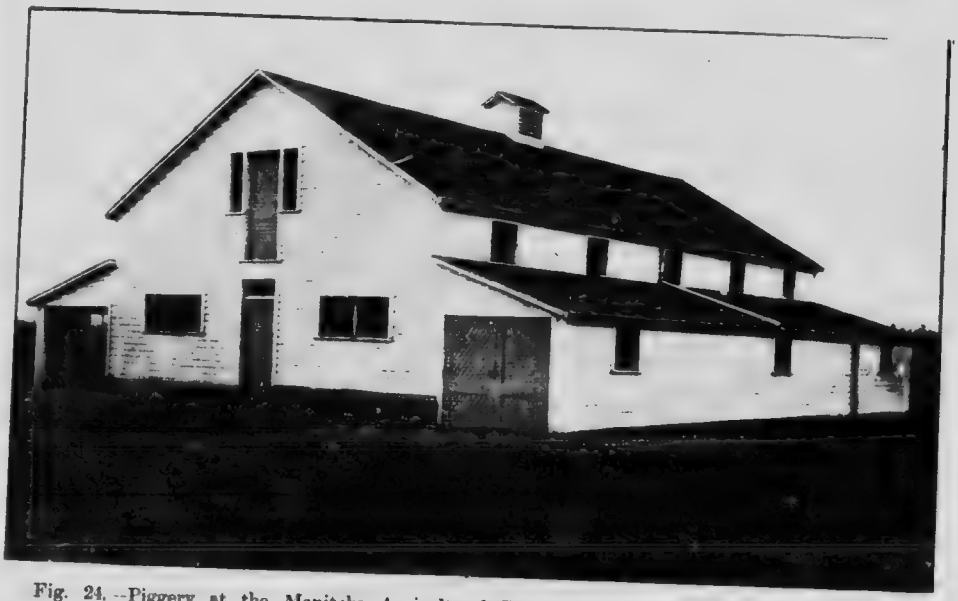

Fig. 24.—Piggery at the Manitoba Agricultural College—North Side. (Photographed before ventilators were put on.)

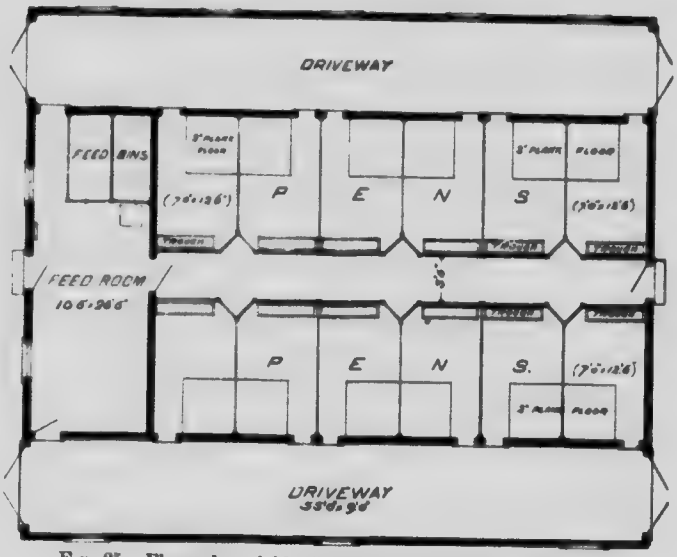

Fig. 25.—Floor plan of Manitoba Agricultural College piggery.

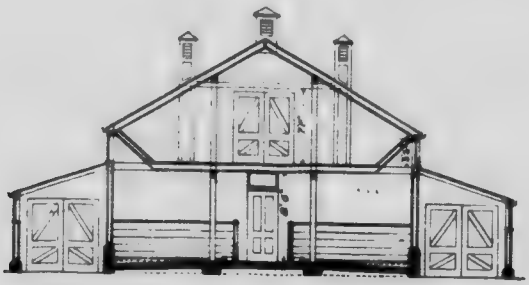

Fig. 26.—End elevation of Manitoba Agricultural College piggery.

Fig. 27.—A well lighted Piggery. Lower windows light the south row and upper windows the north row of pens.

Fig. 28.—Interior view of well lighted Piggery showing the north row of pens lighted from the upper windows.

A QUEBEC PIGGERY.

At Cap Rouge, near Quebec City, Mr. Gustave Langelier has in use a hog pen which is admirably adapted for a cold climate. It has the unusual feature of an exercising shed at the side extending the full length of the main building. This building is provided with artificial heat from the boiler house for warming the farrowing pens in the winter season.

This piggery is built on ground that slopes towards the south-east, the floor of the main building being about seven feet higher than that of the exercising shed, while the roof of the shed joins the buildings just below the windows. The main building shown in Fig. 21 is 90 ft. x 30 ft. and 9 ft. high to the ceiling. At the western end a manure shed 30 ft. x 12 ft. and 10 ft. high joins the building, while along the south side the exercising shed, 102 ft. x 15 ft., runs till met by the wood shed, the boiler house and storage rooms, which extend along the eastern end. The wood shed is 23 ft. x 16 ft. and 12 ft. high. The boiler house is 16 ft. x 16 ft. and 10 ft. high and the storage shed 16 ft. x 6 ft.

The main building stands on a stone foundation 18 inches thick and the walls are of wood. Rough lumber, building paper and clapboards form the outside, while inside the studding is sheeted and sealed with matched lumber. There are windows in each side; each are 3 ft. 6 inches x 3 ft. 6 in. and placed 5 ft. 6 in. from the floor. In the exercising shed six windows furnish light; these are insufficient and six more windows are to be put in.

Floor.—The floors of the boiler house, manure shed and piggery except over the cellar are of concrete, six inches thick. The first four inches are made up of five parts gravel, three parts sand to one part of cement; the top two inches are composed of four parts of sand to one part of cement. As soon as the concrete dried a little in the pens it was swept with a strong broom to leave a rough surface to prevent the hogs from slipping. In the passages the floor was marked off into 4-inch sections with a mould before it dried.

Two of the farrowing pens, also the feed room, have floors made of two thicknesses of 1½-inch matched lumber with a layer of coal tar between put on hot. The partition outside of four farrowing pens is tight boarded to the ceiling, while the passages are closed by doors to conserve the warmth. A 10-inch galvanized iron pipe carries hot air from the boiler house to keep the young pigs comfortable during the winter. The fenders in the farrowing pens are of inch pipe placed 10 inches from the floor and about the same distance from the walls.

The fronts of all the pens swing over the troughs, each having an iron bar to hold it where wanted. This arrangement is similar to that shown in Fig. 28—the interior view of well-lighted piggery.

The 'King' system of ventilation, which is the one installed, has given fair satisfaction in moderate weather, but during periods of low temperature it has to be closed for the comfort of the animals.

Drainage.—The drainage from the pens flows into the passage and along the sides of this to the manure shed. To facilitate the flow of liquid the floor of each pen falls three inches toward the passage and three inches toward one side, which is the side nearest the manure shed. A groove conducts the liquid to the passage under the door at the end of the feeding trough in each, except the two last pens. The doors opening into these being at the higher side a space is left for the escape of liquid between the end of the trough and the wall next the manure shed. The passage falls nine inches from end to end of the building, and being raised at the centre the liquid manure rapidly escapes into the manure shed.

Under the farrowing pens is a cellar 28 ft. x 23 ft. and 7 ft. high, inside measurements, where all the roots, &c., are stored, while overhead is a loft the full size of the main building, with walls four feet high to the plate which holds the cut straw and clover for bedding and feeding.

The boiler house is a solid stone structure, the walls being two feet thick. The six horse power horizontal boiler is encased with brickwork, and all woodwork, including

the doors and door frames, are covered with tin, and the roof is of galvanized iron, making the place practically fireproof.

The feed vats are made of matched and grooved deal lined with galvanized metal throughout. They slope a couple of inches toward one end where a large tap, about six inches in diameter, is situated. The covers are lifted by a rope and pulley attached to the ceiling. A large pipe with a funnel end runs from beside one of these vats to a large trough in the exercising shed to carry the food for the noon meal when necessary. The floor of this is seven feet lower than the floor of the piggery.

A MANITOBA PIGGERY.

A piggery designed for the climate of Manitoba has been built and used for one season at the Agricultural College at Winnipeg. As will be seen from the exterior views, Figs. 23 and 24 and the floor plan Fig. 25, the building has a lean-to on each side to be used as a driveway and as an exercising shed for brood sows and young pigs in rough weather. Fig. 23 shows that the windows on the south side are almost continuous from end to end, while there is much less window space in the north wall. Above the piggery is a loft for storing straw. The floor of this over the side windows slopes, allowing the sunlight to reach the pens on the opposite side. This is shown in the cross-section, Fig. 26. Beneath the piggery is a cellar for storing roots.

The floors of the piggery, except in the feed room, are of cement concrete which is also used for the foundation of the walls and partitions. Each pen is provided with a plank sleeping bed overlying cement. The floors of the pens slope to the alley in order that the liquid may be absorbed by litter. The surface of the feed alley is slightly rounded, leaving a shallow rounded gutter on each side to prevent the walk from becoming wet from liquid slopped out of the troughs.

Ventilation is provided by U-shaped inlets built underneath the wall on each side of the passage at the west end. The outlets consist of four flues passing through the loft and roof as shown in the cross-section, Fig 26, and exterior view of the south side, Fig. 23. These are provided with trap doors at the floor line of the loft, to be worked by cords and pulleys. The photograph, Fig. 24, was made before the outlet ventilators were installed.

The building is 55 feet long and 46 feet 6 inches wide, including the driveways, each of which is 9 feet wide. The piggery is 8 feet 6 inches high to the ceiling. The windows are double throughout. A greater number of windows in the exercising shed would be beneficial. It would also improve the light in the piggery if the lean-to roof had less slope, allowing greater depth for the upper windows.

A WELL-LIGHTED PIGGERY.

A piggery possessing new and desirable features is in use at the Agricultural College at Urbana, Illinois. It was designed by Prof. William Dietrich of that institution. The building is 120 ft. x 30 ft., with an 8 ft. alley between the two rows of pens. It is so arranged that each row of pens is lighted from a row of windows on the south side of the building. Referring to the situation of the windows, Prof. Dietrich writes: 'The important factor to consider is the height of the windows, represented at E and D, in connection with the width and manner of construction of the building. The window E is so placed that at noon of the shortest day of the year the ray of light which passes through the upper part will fall upon the floor of the south side pen on the opposite side from the window. This allows the total amount of light coming through the window at this season of the year, and time of the day to fall within the pen. In the morning and in the afternoon when the sun is not at its highest point, a part or all of this beam of light will pass beyond the pen. The lower part of the window D in the upper part of the building performs the same function for the pen on the north side of the alley as does the window E for the pen on the south side. By this arrangement the pen floors receive the greatest amount of light at a time when it is most needed, viz., during the winter months, to warm and dry the building.

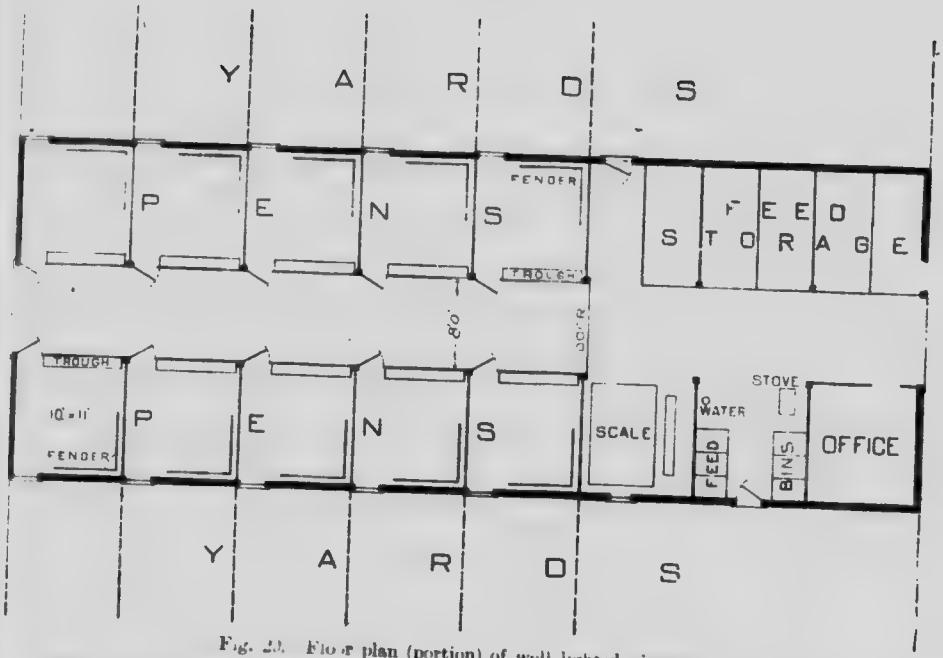

Fig. 29. Floor plan (portion) of well lighted piggery.

The ground floor is represented by Fig. 29. The alley, 8 feet wide, allows of driving a cart through either to bring in feed, &c., or take out the manure. The pens are 10 feet wide by 11 feet deep. Each has a doorway leading to the outside which is opened by sliding upwards and a door leading into the alley. These doors open so as to turn the pigs toward the front of the building where the weigh scales are situated. Fig. 28—the interior view—shows a swinging panel above the trough. The fender K is made of 2-inch tubular iron bar placed on 9-inch iron posts of the same dimensions and set in concrete in the floor, 6 inches from the wall. This is to prevent the sow crushing her pigs at farrowing time, as she will necessarily make her bed in the unoccupied corner. The platform scale is fitted with a frame and the door opens so as to facilitate turning pigs upon the scales. A smaller door at the opposite end leads to a door through which the pigs may be driven to a loading chute. The large feed bins have openings from the main alley, so that feed can be unloaded directly from the wagon.

An alley leads through the door beside the feed storage to the yard outside. The two large yards may be used for boars. They are separate from the others and supplied with cots and troughs outside. The remaining yards are each 28 feet long, but may be any length desired and may lead to the pasture. The yard partitions are made of two lengths of common fencing, 16 feet and 12 feet, respectively. The latter is next the building and made into a gate so that it will swing. By opening all these gates and swinging them free away from the building an alley is formed for cleaning the pens if required.

For drainage purposes the floor of each pen slopes to a grating over a 4-inch drain which leads to a main drain outside of the building. The grating is laid in the bell end of a large sewer pipe. The floor and the drains may be flushed with water.

All the gates and partitions inside the building are made of wire netting panels. Wire allows the sunlight to reach all parts of the pen, allows the hogs to see one another and the attendant. This makes the sows and young pigs quieter and prevents them from fighting when put together. Part of the floors are of brick and part of cement. The bricks are laid on side in the pens and on edge in the alleys. A wooden floor of 1-inch or 1½-inch lumber could be laid in the corner of each pen for a bed for the hogs.

VII.—REARING AND FINISHING.

Care is necessary at weaning time to get the pigs safely over this crisis in their lives and well started without any serious set-back. Many breeders sacrifice the profit from a batch of pigs because of lack of skill or care in weaning. Sanders Spencer, speaking on this point, says: 'There are more pigs lost or irretrievably ruined when they are first weaned than at any other time in their existence.' It is undoubtedly true that many pigs receive a check at this time from which they never recover. A stunted animal of any kind is always unprofitable, and this is doubly true of a pig. With him especially, life is too short to recover losses due to mistakes that might have been avoided.

Among the errors into which one is most liable to fall at this time is that of feeding a strong grain ration to compensate for the loss of the mother's milk. The pigs, if well managed, should be eating so freely at the trough as nearly to wean themselves, and no change should be made in the ration unless it be to add a little skim milk. Even this had better be done some time before the removal of the sow. The loss of the dam's milk, small though it may have become in quantity, is change enough at one time.

Another mistake is that of over-feeding. Before the removal of the sow, just as much food should be given as she and the litter will clean up at each feeding; when the sow is taken away the feeder, either from mistaken kindness to the pigs, or from a failure properly to estimate their requirements, may overfeed to such an extent that food often lies in the trough from one feeding to another. This is a mistake for two reasons: the weanlings, missing their dam, are tempted to overtax their digestive systems; and the portion of the food remaining in the trough is apt to become foul as a result of fermentation and other causes. In either case digestive troubles will inevitably follow; and these, if not fatal to the pig, are disastrous to the owner's chance of profit. While the other extreme also must be avoided, it is better for a while at least to err a little on the side of under-feeding than to overfeed. Ideal conditions would be to feed at frequent regular intervals as much as they will eat up clean in a few minutes after feeding. It is not often possible to make our practice conform wholly to the ideal, but the nearer we can approach to it the better will be our success.

A mixture of middlings and chopped oats, supplemented with a little skim milk, constitutes an excellent ration for weanling pigs. It is rich in ash and protein for the nourishment of the growing bones and muscles, thus enabling the pig to build up framework rather than to lay on fat. It not only furnishes the right kind of nourishment for a growing pig, but supplies it in a palatable and easily digested form. For pigs under twelve weeks the oat chop should be passed over a coarse screen, to remove most of the hulls. If this be done, it may be well to add as much bran in bulk as was removed of oat hulls. The bran is more palatable and more easily digested than the oat hulls, and it lightens up the ration, preventing the meal from lying in too close and solid a mass in the stomach. The addition of the bran, however, will depend on the quality of the middlings used, and it devolves upon each individual feeder to exercise his personal judgment in this matter. The nature of the material sold as middlings by different mills varies from coarse, dark coloured flour to finely ground bran. The feed stuff the writer has in mind, when speaking of middlings, would consist of about an even mixture of these two materials.

Roots or some other kind of green food, either in the form of pasture or a soiling crop cut and fed in the pen, should be gradually introduced until they constitute about one-half of the ration, by the time the pig is three months old. Many practical feeders are firm in the belief that, in summer, pigs can be most cheaply raised on pas-

ture supplemented with a light grain ration. There is much to be said in favour of the practice, especially since the labour question has become so acute. The hogs, having unrestricted access to earth and taking plenty of exercise, are vigorous and healthy; there is never any trouble with paralysis or with pigs going 'off their feed'; and with good fences a large herd can be carried in this way with a minimum of attention, interfering little or not at all with the ordinary operations of the farm.

PASTURING AND SOILING.

Experiments conducted by Prof. Day at Guelph in 1901 and again in 1902 to test the relative economy of pasturing and soiling pigs seem to indicate that cheaper gains are obtained by soiling. In 1901, Prof. Day conducted an experiment in which 34 pigs were fed. Eighteen of these pigs were fed in pens with access to an outside yard, and sixteen were turned into a pasture of ordinary tares until August 6, when they were turned into rape pasture. Both outside and inside hogs were fed twice a day what meal they would eat readily. The meal was fed dry, and consisted of two parts barley to one part middlings by weight. The inside hogs were fed in addition to the meal all the green food they would eat, receiving tares until August 6 and rape after that date; exactly the same forage as that on which the other lot were pasturing. The experiment was commenced on July 6, and on October 14 all of the inside pigs and some of the outside pigs were ready for shipment. Seven Berkshires and three Yorkshires of the outside bunch were still unfinished and had to be carried over until November 12, when they, too, were shipped to the slaughter house.

The meal consumed per 100 lbs. gain was as follows:—Group on pasture, 525 lbs. Group fed in the pens, 395 lbs.

The packing house reported on the pigs as follows:—

'The last shipment of hogs which you sent to us is just out of salt, and we have to report to you that the sides without exception show a very satisfactory degree of firmness. Our inspector's report is that all the sides grade No. 1 in respect of hardness, and my own judgment of the sides, going over them trying to find differences that might be of some value to you, was that there was practically no difference between the different sides, either in the groups themselves, which you designated by A and B, or in contrasting the two groups. Whatever your method of feeding has been in regard to these particular hogs, you certainly have discovered some system that gives you excellent results.'

Prof. Day sums up the experiments as follows:—

1. In this experiment feeding hogs on pasture proved a very expensive method, whereas feeding in pens with same kinds of food gave reasonably economical gains.

2. The outside hogs ate more meal and made slower gains than those fed inside.

3. All the hogs produced bacon of satisfactory firmness. This confirms the result of a previous experiment with rape, and goes to show that a reasonable supply of green feed with a liberal meal ration produces a good quality of bacon.

4. Succulent food tends to keep animals thrifty, whether it be green food or roots, and thriftiness is conducive to firmness in the bacon produced.

5. The inside hogs consumed, on an average, nearly 4 pounds of green food each per day, together with 4½ pounds of meal.

6. As this proportion of green feed to meal ispractically the same as the proportion of roots to meal which we have used with good results, it seems safe to assume that the use of equal weights of succulent food and meal tends to produce bacon of firm quality.

7. The time required to attend to the outside hogs was just about half of that required for those inside.

A similar experiment conducted in 1902 resulted in favour of soiling, but not to nearly so marked an extent as in the previous year.

It must not be forgotten that the pigs fed in the pens had the run of a small paddock in which they took exercise at will, and had unrestricted access to the clay. Where these conditions do not obtain so good results cannot be had from soiling. It must also be remembered that, although greater gains may be obtained from a given amount of food consumed, there is a considerable item for labour to be included in the cost of pork produced in this way. Whether or not it will pay any given farmer to pasture his hogs in summer, or to cut green forage and cart it to them in the pens, will depend largely on the facilities he has at his disposal, especially in the matter of labour.

Probably rape is the most valuable crop for this purpose or for pasturing. It grows rapidly and may be sown at successive intervals so as to furnish a continuous supply from the first of June until the frost; it furnishes a large supply of food from a given area; although hogs do not take to it readily at first they soon acquire a taste for it and eat it freely; and it has an excellent effect on the quality of the product, producing almost invariably a firm carcass.

For hogs, rape should be sown somewhat thickly in rows about 24 to 28 inches apart. Three pounds of seed per acre will give a very good stand, if the seed is fresh and of good quality. If the rape is too thin it grows somewhat coarse in texture and the pigs do not eat it so readily.

Another valuable green crop for hogs is alfalfa. Pigs are fond of it and will make very satisfactory gains if it is fed with discretion. It should be fed before it blossoms or it becomes too woody; and is not only less palatable, but also less digestible. Common red clover is also excellent; peas, vetches, almost any succulent forage crop may be used with advantage.

For winter feeding the succulent portion of the ration can be most cheaply and satisfactorily furnished in the form of roots, preferably mangels or sugar beets.

It has been pretty well established that hogs cannot be fed to the best advantage on an exclusive grain diet, especially during the growing period. The result of heavy grain feeding is to check growth, and to cause the pig to lay on flesh and become too thick and fat before the desired weight has been attained. (See Figs. 3, 6 and 8.)

He is the most successful feeder who maintains his pigs on a cheap, bulky, easily digested ration, rich in bone and muscle forming elements, until they reach a weight of from 130 to 150 pounds, then finishes on a stronger ration until they are in prime condition, but not too fat and weigh from 180 to 220 pounds.

VIII.—THE COST OF RAISING SWINE.

The question of ascertaining the cost of raising hogs from birth to marketing has been subjected to much more controversy than experimentation. So few swine raisers find time to keep an accurate account of the quantities of food used by their hogs from day to day the question of gaining information on this point is left largely to experiment stations. During the past year, however, valuable data has been secured, through the co-operation of Prof. Day of the Ontario Agricultural College, upon the average cost of raising hogs to bacon weights upon Ontario farms. The work was undertaken at the suggestion of one of the leading bacon curing firms in Canada, who encourage it by offering to pay for finished hogs 50 cents per cwt. above the market price when the pigs were marketed to those who would render a full report upon the food consumed by the hogs from the time of weaning until shipped to market, and upon certain other points necessary to an intelligent study of the question. No restrictions whatever were placed upon the feeders regarding the kinds of food used or the methods of feeding to be followed, these being left entirely to the discretion of the farmers to whose interests it would be to feed in the manner found by each in his experience to yield the greatest profit upon his own farm. In all ten reports were received, each accompanied by a declaration of accuracy signed by the experimenter.

The following table prepared by Prof. Day presents many interesting facts. It is worthy of very careful study inasmuch as it represents hog-feeding carried on, under normal farm conditions, in not less than seven counties extending from Victoria on the east to Oxford, Middlesex and Bruce in the west and north.

TABLE 1.—DETAILS OF CO-OPERATIVE EXPERIMENTS.

Lot.	No. of pigs.	How bred.	Cost at weaning time.	Age when sold.	Weight when sold.	Food Consumed.	Cost per pound when meal is worth per ton:			
							$20.00	$21.00	$22.00	$23.00
				Days.	Lbs.					
No. 1...	9	York. boar, Grade Tam. and Chester White sow	$13 50	217	1800	Barley, 3552 lbs.; shorts, 905 lbs.; mangels, 740 lbs.; green clover, 285 lbs; skim milk, 1620 lbs.	$3 56	$3 68	$3 80	$3 93
No. 2...	12	Yorkshire	18 00	224	2425	Barley, 5374 lbs.; shorts, 1169 lbs.; mangels, 815 lbs.; green clover, 390 lbs.; skim milk, 2,160 lbs.	3 77	3 90	4 04	4 17
No. 3...	12	Yorkshire	18 00	247	2360	Meal (barley, oats, peas and shorts), 7333 lbs.; mangels, 545 lbs.; skim milk, 2520 lbs.....	4 05	4 21	4 36	4 52
No. 4. .	10	Yorkshire.....	15 00	238	2050	Meal (barley, peas and oats), 517 lbs.; shorts, 1038 lbs.; mangels, 3200 lbs.; milk, 2050 lbs ..	4 06	4 21	4 36	4 52
No. 5...	7	Berk. boar, York. sow....	10 50	233	1525	Barley, 1960 lbs.; wheat, 1300 lbs.; oats, 800 lbs.; mangels, 6000 lbs.; skim milk, 8800 lbs	4 58	4 71	4 84	4 97
No. 6...	10	York. boar, Tam. sow....	15 00	177	2060	Meal (barley, oats, wheat, peas) 4215 lbs.; shorts, 816 lbs.; whey, 1500 lbs.; miscellaneous foods, valued at $5.00.	3 70	3 82	3 94	4 07
No. 7. .	14	Yorkshire	21 00	213	2740	Barley, 1243 lbs.; shorts, 4600 lbs.; corn, 1585 lbs.; milk, 9330 lbs.; small potatoes (3 bags) and pasture, valued at $5.90.....	4 20	4 33	4 47	4 61
No. 8. .	7	Yorkshire Grades....	10 50	194	1300	Meal (barley and oats), 2230 lbs.; shorts, 274 lbs.; milk, 3960 lbs., pasture and green feed, $5.00 .	3 57	3 67	3 79	3 86
No. 9...	14	Berk. boar, Grade York. sow	21 00	179	2740	Meal (barley and peas), 10016 lbs.; mangels, 3300 lbs.; milk, 4020 lbs.....	4 76	4 94	5 12	5 31
No. 10..	8	Tam. boar, Grade York. and Tam. sow.....	12 00	200	1740	Barley, 3115 lbs.; shorts, 390 lbs.; mangels, 600 lbs.; milk, 1200 lbs.; 51 days on stubble without other food.....	2 84	2 94	3 04	3 14

In order to arrive at a uniform basis of calculation the cost of the pigs up to weaning time was placed at $1.50 each. This is 23c. higher per head than weanlings from a large number of sows cost at the Ontario Agricultural College when due consideration was made for the food consumed by the sows during their idle period.

The grain foods were valued at $20, $21, $22 and $23 per ton in order to correspond as nearly as possible with values of crops whether produced upon the farms where the feeding was done or where these had to be purchased. The foods valued at these prices included bran, shorts and chopped coarse grain. The values placed on supplementary foods were as follows: Skim milk and buttermilk, 15c. per cwt.; whey, 4c. per cwt.; roots and other green foods, $2 per ton. The values for pasture and miscellaneous foods appear in the table and represent about the values placed on these by the experimenters.

Attention may be called to the uniformity of cost, excepting lot 10, although the feeding was done under the variable conditions of breeds and grades of swine and of methods of feeding found in different parts of the province.

In the case of lot 10 the hogs gathered their food from August 1 to September 20 on a stubble field of mixed oats and barley on which the crop had lodged badly, leaving much shelled grain on the ground. Since the food gathered by the hogs would have been otherwise lost no value was placed upon it. This group is not included in the general average, but it is inserted in the table as an example of how live stock can frequently make profitable use of what would otherwise be wasted.

COST OF GAIN AT DIFFERENT STAGES OF GROWTH.

As pigs increase in weight, the amount of feed eaten daily increases rapidly; the daily gain increases also, but not in the same ratio; so that the amount of feed consumed per 100 pounds of gain increases with the weight of the pigs. This is well illustrated by an experiment by Prof. G. E. Day at Guelph testing a number of pure breeds of swine. In reporting this experiment Prof. Day says:—

'In the experiments with pure bred hogs a rather interesting point was brought out incidentally. It has been shown by other experiment stations that the cost of producing a pound of gain in hogs increases as the animals become heavier. As our pure bred hogs were weighed at regular intervals and as every pound of meal they consumed was carefully weighed, an opportunity was afforded to test further the truth of the claim, and a statement of the results is given below. These results are computed from the gains made and the food consumed by 36 hogs, so that they afford very conclusive evidence. In computing the average weights of the hogs, fractions of pounds were omitted, the nearest whole number of pounds being taken in each case.'

The following is a statement of food consumed for one pound of gain by hogs of different weights:—

'While increasing in live weight from 54 pounds to 82 pounds, hogs required 3·10 pounds meal per pound of gain.

'While increasing in live weight from 82 pounds to 115 pounds, hogs required 3·75 pounds meal per pound of gain.

'While increasing in live weight from 115 pounds to 148 pounds, hogs required 4·38 pounds meal per pound of gain.

'While increasing in live weight from 148 pounds to 170 pounds, hogs required 4·55 pounds meal per pound of gain.

'This statement shows that there is a steady increase in the amount of meal required to produce a pound of gain as the hogs increase in weight, and is a strong argument in favour of marketing hogs by the time, or a little before, they reach 200 pounds in weight.'

Prof. Henry, in his book, 'Feeds and Feeding,' gives the following data, which is especially valuable and reliable by reason of the large number of animals fed and reported on; it also agrees with Prof. Day's experiment. The last column will be found especially interesting to the practical feeder. The food used is valued at $1 per cwt.

Weight of pigs in lbs.	Actual average Weight.	Number of stations reporting.	Total number of trials.	Total number of animals fed.	Average feed eaten per day.	Feed eaten daily per 100 lbs. live weight.	Average gain per day.	Feed for 100 lbs. gain.	Cost per 100 lbs. gain.
	Lbs.				Lbs.	Lbs.	Lbs.	Lbs.	$ cts.
15 to 50	38	9	41	174	2·23	5·95	·76	293	2 93
50 to 100	78	13	100	417	3 35	4·02	·83	400	4 00
100 to 150	128	13	113	495	4 79	3·75	1·10	437	4 37
150 to 200	174	11	107	489	5 91	3·43	1·24	482	4 82
200 to 250	226	12	72	300	6 57	2·91	1·33	498	4 98
250 to 300	271	8	46	223	7·40	2.74	1·46	511	5 11
300 to 350	320	3	19	105	7·59	2·35	1 40	535	5 35

CONDIMENTS OR CORRECTIVES.

Hogs that are closely confined and highly fed require a corrective of some kind to maintain the digestive system in a normal condition of health, and the fatter the pig the greater the necessity. When the digestive organs become clogged with fat, their ability to digest and assimilate is weakened. When a hog is running at large, he does not root up the pasture from pure love of exercise, nor does he do it from innate cussedness. He roots to obtain something for which his system craves. It is the craving that causes a confined pig to gnaw and tear at the trough and the sides of the pen. Hogs have been known to tear apart brick walls in order to get at the mortar. The cause of this unnatural craving is not well understood. It may be due in part to a lack of ash in the food; for, as has already been stated, a hog may be getting all the grain he can eat and yet be partially starved, because certain requirements of the system are insufficiently supplied. It has been attributed by some to the presence of intestinal worms; and by others to some form of indigestion. Whatever may be the part played in the animal economy by these substances, one thing is clear, that when they are supplied, hogs are heartier, eat better, thrive better, and consequently pay better.

Charcoal is probably one of the best correctives; and when it can be readily obtained it will pay to keep a supply in some place where the hogs can get at it whenever they wish. The following preparation was used by the late Theodore Louis, one of the most successful hog feeders in the United States, and found to be an excellent tonic:—

'Take six bushels of corncob charcoal, or three bushels of common charcoal; eight pounds of salt; two quarts of air-slaked lime; one bushel of wood ashes. Break the charcoal well down with a shovel or other implement, and thoroughly mix; then take one and one-quarter pounds of copperas and dissolve it in hot water. With an ordinary watering pot sprinkle this over the whole mass and then again mix thoroughly. Put this mixutre into the self-feeding boxes, and place where hogs of all ages can eat of the contents at pleasure.'

The charcoal furnishes the required mineral matter which may have been lacking in the food, and is also an excellent corrective for digestive troubles, while the copperas is a valuable tonic and stomachic.

If the charcoal is hard to get, its place is taken almost as well by sods of earth rich in humus. It is questionable, indeed, if there is anything better than sods or vegetable mould taken from the wood lot. If a small quantity be thrown in each pen daily, it is astonishing to see how much of it the hogs will consume; and the improved health and thrift of the animals will be a revelation to the feeder who has never before tried it.

FEEDING ASHES AND BONE MEAL.

Ground bone, wood ashes, soft coal, old mortar, rotten wood, &c., are also among the substances used and recommended for this purpose. Prof. Henry reports some interesting experiments to test the value of bone meal and hardwood ashes when given as a supplement to a ration of corn. In all, three experiments were conducted in each of which six pigs were fed. These were divided into three lots and all were fed liberally on cornmeal and water. Lot one got nothing else; lot two was given hardwood ashes in a separate trough; lot three was given a spoonful of bone meal mixed with their food at each feeding. The pigs were confined in pens with access to small yards for exercise. These yards were floored with boards to prevent the pigs from getting at the earth and eating quantities of it, which those, especially, that were not getting either ashes or bone meal would have done. The various trials lasted from 84 to 128 days.

Concerning the results of the experiments, Prof. Henry says:—

'As the trials progressed it became evident that none of the pigs were properly nurtered, though the differences in favour of those getting bone meal or ashes was very marked. The pigs allowed neither ashes nor bone meal were most painfully dwarfed. It was evident that the corn meal, salt and water did not supply all the elements essential to building a normal framework of bone and muscle. These dwarfs became so fat that the jowls and bellies of some of them nearly touched the ground.

'The pigs getting ashes or bone meal grew very well for some time, but toward the close of the trial they made only fair gains, showing that the nutrient supplied were still too limited in character to allow normal development. On slaughter the several lots showed no difference in the proportion of fat to lean, nor was there any difference in the size and character of the various internal organs. The bones, however, were a most interesting study. The thigh bones of these pigs were broken in a testing machine, with results shown below.'

The following table shows results with pigs living on corn meal with or without bone meal and hardwood ashes in addition. (Wisconsin station.)

—	When bone meal was fed.	When ashes were fed.	When neither was fed.
Cornmeal required to produce 100 lbs. of gain	487 lbs.	491 lbs.	629 lbs.
Average breaking strength of thigh bones	680 "	581 lbs.	301 lbs.
Average ash in thigh bone	166 grams.	150 grams.	107 grams.

IX.—SOFT BACON.

Economy of gain is [illegible] matter to be considered in outlining a system of feeding and managem[illegible] lity of the product is of quite equal importance. In August, 1905, [illegible] and Irish bacon was quoted 13s. per cwt. higher on the English market [illegible] Canadian. This difference in price, if it could be obtained would net th[illegible] farmer about $1.50 per cwt. live weight mo[illegible] for his hogs than he has been [illegible] oretofore which, it is needless to say, would very considerably enhance his p[illegible]

The defect in our bac[illegible] [illegible] h dealers complain the most, and which is chiefly responsi[illegible] [illegible] the prices above quoted, is the large percentage of soft side[illegible] [illegible]ly going forward among Canadian shipments. It is true that [illegible] qual[illegible] our products has been very much improved during the past two or three years [illegible] here is still much to be done in this regard before we can hope to top the Eng[illegible] ket and before our bacon industry can be said to have reached the limit of its possibilities as a source of profit to Canadian farmers.

Soft bacon does not necessarily imply fat bacon. A pig may be thick fat and yet kill out a firm carcass; on the other hand, a thin, underfed pig like those shown in Fig. 1 is almost sure to be soft. The terms 'soft' and 'firm' refer to the condition of the fat in a side of bacon when it is taken out of the salt. Sometimes it may be noticed before the bacon goes into the salt; but frequently sides that were apparently firm when put into the salt will come out decidedly soft. Softness reduces the value of a side in proportion to its degree; a very soft side is comparatively worthless; and between this condition and firmness there are many degrees of tenderness. This is a condition entirely beyond the control of the curer. Of many thousand hogs, killed on the same day and put through the same process of curing, some will come out of the salt firm, almost hard; others so soft as to be almost worthless; and others of every conceivable shade of difference between these two extremes. It is clear, therefor, that the remedy must lie with the producer of the hog.

Many theories have been advanced in attempting to account for this softness in our bacon. It has been said to be due to overfeeding and forcing hogs to heavy weights at an early age; but the packers report that they find more softness among thin and unfinished hogs than among the thick fats. It has been said to be due to lack of exercise; and yet perfectly firm bacon has been produced from hogs that have had very little exercise. The feeding of corn has been said to be responsible; but many soft sides come from pigs that have never tasted corn; and hogs fed on a ration containing a considerable percentage of corn, especially when supplemented with dairy by-products, have produced bacon of the finest quality. Feeding succulent foods, such as rape, clover or roots was for a time thought to be the cause; but experiments have shown that these foods, when fed in conjunction with a fairly liberal grain ration, have a decidedly beneficial effect on the quality of the bacon produced. Hogs enclosed in the same pen and fed at the same trough have been found to differ in the firmness of the bacon.

In 1898 Prof. Day commenced a series of experiments to determine if possible some of the causes that may produce soft pork. These experiments have been continued each year since that date, and hogs have been fed on nearly every kind of ration that was likely to be used by the farmer, and kept under all and various conditions practicable. These hogs when finished were shipped to the Wm. Davies Co., of Toronto, who killed and cured them and reported on the quality of the product after coming out of the salt. In this way much valuable information has been obtained, from which the following deductions may fairly be drawn:—

1. An exclusive corn ration, continued for any length of time, will give unsatisfactory gains, and produce soft bacon.

2. Corn as a considerable portion of the ration may safely be used to finish thrifty shoats that have had plenty of exercise and a ration of mixed grains until they have reached a live weight of 100 lbs.

3. Pigs that have been raised to 100 lbs. live weight on a ration of mixed grain and skim milk may be finished on a ration largely composed of corn without any bad effect on the quality of the bacon.

4. An exclusive ration of peas will give unsatisfactory gains, which are always associated with inferior bacon, but when fed in mixture with other grains, peas will produce bacon of excellent quality.

5. Barley, either alone or in mixture with oats or middlings, will produce bacon of the very best quality.

6. Exercise contributes to firmness, but will not overcome the bad effect of a faulty ration.

7. Skim milk and whey are exceedingly valuable in their effect on the quality of the bacon.

8. Succulent food, such as roots, rape, clover, &c., when fed to the extent of about half the ration by weight are conducive to the production of firm bacon.

9. Unthrifty, unfinished hogs, or those that have been held for a time on a short allowance to prevent them from becoming too heavy, while holding for improved prices or any other reason, have a marked tendency to softness.

Similar experiments were conducted in 1901 by J. H. Grisdale, Agriculturist, and F. T. Shutt, Chemist at the Experimental Farm, Ottawa, and these corroborate the conclusions of Prof. Day.

When all the experimental evidence is reduced to its last analysis, it seems to indicate that the firmness of the bacon depends largely if not altogether on the health of the animal slaughtered, and that any ration or system of management that will maintain the hogs in a normal condition of health and thrift will produce firm bacon.

(NOTE.—For details of the experiments above quoted, see Reports of the Ontario Agricultural College for the years mentioned, and Bulletin No. 38 of the Central Experimental Farm, Ottawa.)

X.—FOODS.

BARLEY.

It is only during recent years that Canadian farmers have awakened to a fair appreciation of the feeding value of barley; but, in Great Britain and in Denmark, it has long been regarded as the best of all the cereals for hogs. Its value consists not only in the satisfactory gains obtaind from it, but also in the superior quality of the bacon produced. The bacon produced from barley fed hogs is esteemed in England as of the very finest both in flavour and in texture. Barley is, perhaps, the only cereal that can be fed alone with satisfactory results; although, like other grains, it is better fed in combination with something else. Oats, middlings, bran in small quantities, skim milk and whey, all make excellent complements to feed with barley meal.

In extensive Danish experiments to test the relative values of corn, barley, rye and a mixture of barley and rye, the pigs fed on corn made a little the largest gains per cwt. of food consumed; the lot fed on barley and the lot fed on rye were practically equal to each other, and the lot fed on barley and rye mixed gave about the same gains as the lot fed on corn. The corn fed pork was much the poorest in quality.

Prof. Henry reports an experiment in Wisconsin to test the relative values of barley and corn. With pigs averaging 208 pounds at the beginning of the experiment, 100 pounds of gain was obtained from feeding 471 pounds of barley; and on a similar lot of pigs averaging 209 pounds, 100 pounds of gain was obtained from 435 pounds of corn. 'But,' Prof. Henry adds, 'when we take into account the fact that the Danes have found barley to be the best single grain for the production of bacon of the highest quality its value in swine feeding is apparent.' An interesting feature of this experiment was the fact that the barley fed hogs drank nearly twice as much water as those fed on corn.

Barley is a valuable food for growing hogs, containing all the elements necessary to growth, in about the right proportions. It should, however, be fed very sparingly to nursing sows; it is safer to avoid it altogether because of its tendency to induce a feverish condition of the system. This affects the milk and trouble with the litter immediately follows. Cases have been reported where the loss of large numbers of sucking pigs was attributed to the too liberal feeding of barley to the dams, and as soon as the barley was stopped the pigs began to do better.

WHEAT.

Wheat has a very high feeding value, producing gains quite equal to those obtained from corn.

At the Central Experimental Farm, Ottawa, experiments were conducted to determine the value of frozen wheat from Manitoba in feeding hogs. On hogs averaging 61 pounds at the beginning of the experiment and fed until they averaged 165 pounds, 100 pounds of gain was obtained from 423 pounds of wheat fed.

It was concluded from this experiment that when hogs are selling at 5 cents per pound live weight, with an allowance of 5 per cent for shrinkage, frozen wheat fed under the least favourable conditions may realize 43½ cents per bushel. At the same price for hogs, frozen wheat fed under favourable conditions in quality and age of the hogs, and preparation of the feed, may realize practically 73½ cents per bushel.

Prof. Henry summarizes experiments at four leading American stations as follows:—

Station.	Average weight at beginning		No. of days fed.	Feed eaten.		Feed for 100 lbs. gain.	
	Cornmeal fed.	Wheat meal fed.		Cornmeal.	Wheat meal.	Cornmeal.	Wheat meal.
	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.
Kansas	152	163	77	2,294	2,257	439	411
Ohio	136	137	70	1,228	1,275	453	438
S. Dakota	96	103	90	1 159	1,144	458	481
Wisconsin	243	247	63	1,212	1,206	499	522
"	247	247	126	9,014	6,054	496	465
Average						469	463

It is only during a period of very low prices for wheat that it can be economically used for feeding purposes. Under ordinary conditions it will pay the Canadian farmer better to sell his wheat and buy other feeding stuffs. Damaged grain, however, such as sprouted or frosted wheat, may be turned to a useful purpose by feeding it to hogs.

MIDDLINGS.

The value of wheat shorts or middlings as a food for both young and older pigs is well known. Experiments have shown middlings superior to corn in the proportion of 108 to 100. A combination of the two was found to be 20 per cent more economical than middlings alone. Shorts has a tendency to produce soft and undesirable pork, therefore should never be fed except in combination with peas, barley, corn and other grains. If, however, skim milk or whey is fed in combination with the ration of which shorts forms a part, and in addition to this the hogs get plenty of exercise, the quality of the bacon will be much improved.

Middlings is especially valuable for nursing sows and young stock, because of its high per cent of ash and protein with the additional advantage of having comparatively little fibre. Henry places it next to the by-products of the dairy for young pigs, and this judgment is borne out by the experience of most, if not all, practical feeders.

BRAN.

Like middlings, bran is rich in ash and protein, but its high percentage of fibre makes it unsuitable for very young pigs. As they increase in size, bran may be gradually added to the ration with advantage. Its chief value is to lighten up heavy meals, such as finely ground corn or pea meal, low grade flour, &c., which tend to form so close and dense a mass in the stomach of the animal as to be more or less impervious to the digestive fluids.

PEAS.

Peas are an excellent adjunct to other grains in swine feeding. They are exceedingly rich in protein, and are therefore an excellent complement to corn in compounding a ration for young and growing stock. They are, however, somewhat hard to digest, owing probably to the heavy nature of the meal, and must therefore be fed with discretion. When fed alone for any considerable length of time, they have not given very satisfactory results either in point of gain or in the quality of the product.

OATS.

Oats are a standard food for all kinds of young and growing stock, not excepting pigs. They are easily digested and are rich in just the kind of nourishment that the

growing animals require. The one objection to them for pigs is their large percentage of hull, which renders them somewhat unpalatable to small pigs. The stomach of a small pig is limited in its capacity, as compared with that of a calf or lamb, and was not designed for the digestion of any considerable quantity of vegetable fibre. This objection to oats may be overcome by screening out the coarsest hulls. If this be done perhaps no better ration can be devised for nursing sows or weanling pigs than a mixture of chopped oats with middlings and a little skim milk. For fattening hogs, oat chop is a valuable addition to corn or pea meal, in the ratio of about one of oats to two or three of corn or peas. The oat chop tends to lighten up the heavy meals, making them more open and digestible.

CORN.

As a cheap fattening food for all classes of farm stock corn stands without a peer. There is little doubt that with mature animals more rapid gains can be obtained at less expense from corn than from any other single cereal. The ease with which it can be produced, its exceedingly high nutritive value, its digestibility and palatability, give the stockmen within the corn belt a long lead in almost every branch of animal industry.

Corn has, however, its limitations, and these are especially marked in the production of high class bacon. The high percentage of starch and fat that it contains, and its relative deficiency in ash and protein make it pre-eminently a fat and heat producing food, and render it quite unsuitable as the basis or main part of a ration for growing stock. In the production of Wiltshire bacon, growth promoting or bone and muscle producing foods are essential. Corn, therefore, cannot be used to any large extent by Canadian pig-feeders, unless it be liberally supplemented with foods rich in those elements in which corn is deficient. Skim milk is the exact complement of corn and if the pigs are getting from three to five pounds of skim milk per day, corn may be fed to the extent of about half of the grain ration, with excellent results, both in economy of gain and quality of product. Or, if hogs are well grown to a weight of say 130 pounds on a good muscle forming ration, and have had enough exercise to keep them in vigorous health, they may be finished on a ration containing a much larger percentage of corn without any bad effect on the quality of the bacon. But if corn is made the main part of a ration for a young, growing pig, it results in the production of a stunted, undersized, fine boned, light muscled, prematurely fat pig, the carcass of which will almost inevitably cure out soft. It is well to remember that a pig may become fat although insufficiently nourished. A growing pig fed exclusively on corn has more heat and fat producing food than he requires, and he stores away the surplus in the form of body fat, while the growing bones and muscles are partially starved. It is equivalent to putting the siding on a building before the framework has been completed.

RYE.

In its chemical analysis, rye is very similar to barley, although slightly richer in protein. Extensive experiments in Denmark have shown the two grains to be almost equal in value for swine feeding. But although the ground rye itself has given excellent results both in amount of gain and in the quality of the bacon produced, the by-products of rye milling, viz., rye, bran and middlings, were found to be very prejudicial to the quality of the product.

BUCKWHEAT.

In experiments conducted at Ottawa buckwheat was found to have a feeding value but little inferior to wheat. This is a much better showing than its chemical analysis would lead one to expect.

In this experiment 14 hogs were fed, divided into three lots, as nearly even in quality as possible.

	Ration fed.	Great eaten per cwt. of gain.	Report of curers on quality of bacon.
Lot 1, (4 hogs)	Ground barley and wheat	428 lbs.	All firm, best of the three lots
Lot 2, (5 hogs)	Ground wheat	410 lbs.	Three hogs cured out soft and two firm.
Lot 3, (5 hogs)	Ground buckwheat	445 lbs.	One hog cured out soft and four firm.

This experiment, although it does not furnish enough data to warrant any definite conclusions, would seem to indicate that buckwheat has considerable value as a food for swine.

BEANS.

J. H. Grisdale, Agriculturist, and F. T. Shutt, Chemist, C. E. F., Ottawa, found that every pig fed on beans or on a mixture of beans and shorts made very unsatisfactory gains, and the carcasses were soft.

This accords with the experience of the packers who have observed that shipments coming from the bean growing districts of Ontario, contain a large percentage of 'softs.' Of course, only damaged beans are fed to pigs at any time, but the evidence is all against them, and Canadian farmers cannot afford to trifle with so fastidious a market as that for high class bacon.

CLOVER (COMMON RED.)

The value of common red clover either as a pasture or as a part of the winter ration for growing pigs is well known. Stewart, in his admirable work, 'Feeding Animals,' reports an experiment in which he fed pigs averaging 75 pounds each with corn meal, two quarts of short cut clover being added to each day's allowance, and the whole wet with hot water, and allowed to stand from ten to twelve hours before feeding. Another lot received meal prepared in the same way, but without the clover mixture. The lot getting clover hay showed the best appetite, the greatest thrift, and made the steadiest gains. The pigs getting meal alone gained 110 pounds each in 120 days, while those having the cut clover hay mixed with their meal gained 143 pounds each, or 30 per cent more.

At the Central Experimental Farm, Prof. Grisdale found steamed clover a very satisfactory substitute for milk, as an addition to a grain ration for growing pigs. The following figures summarizing the experiment are interesting:—

Lot of 6 pigs fed on steamed clover and grain—

To 6 pigs, average weight 73 lbs. at $4.50 each	$27 00
¾ tons clover at $5 per ton	3 75
1,475 lbs. meal at 90 cents per cwt.	13 27
Total	$44 02
By 1,085 lbs. of pork at $6 per cwt.	$65 10
Profit on lot	21 08
Profit per pig	3 51
Cost to produce 100 lbs. pork	2 68

Lot of 6 pigs fed on grain and milk—

To 6 pigs, average weight 46 lbs. at $3 each	$18 00
1,340 lbs. skim milk at 15 cts. per cwt.	2 01
2,003 lbs. meal at 90 cts. per cwt.	18 03
Total	$38 04
By 1,152 lbs. pork at $6 per cwt.	$69 12
Profit on lots	31 08
Profit per pig	5 18
Cost to produce 100 lbs. pork	2 28

ALFALFA.

Alfalfa seems to be even more acceptable to pigs than the red clover. In a pasture in which the two clovers are mixed, the pigs will eat the alfalfa bare to the ground before touching the other. It is important, therefore, that an alfalfa pasture be not overstocked, as this plant will not stand close cropping.

At the Kansas station, alfalfa hay has been found a very profitable addition to the winter ration for fattening hogs. The hay used was of first-class quality, and was fed whole, as an adjunct to corn. It was given freely so that the pigs ate only the leaves and finer portions, rejecting the coarser stems, which, although charged against the hogs, were used as bedding. It was found that the hogs getting alfalfa hay in addition to their grain, consumed more feed but made much more rapid and economical gains. The hogs receiving alfalfa hay in addition to corn made an average gain of 90·9 lbs. in 9 weeks, while those getting corn alone gained only 52·4 lbs. The gains per bushel of feed were as follows:—

One bushel corn and 7·83 lbs. alfalfa hay produced	10·88 lbs. gain.
One bushel corn alone produced	7·48 "

At the Utah station alfalfa hay was fed in addition to a full grain ration of chopped wheat and bran, and the hogs thus fed consumed more grain, and made much larger and more economical gains than those fed on grain alone.

These results, as well as others that might be quoted, if space would permit, indicate that alfalfa has a feeding value in addition to the actual nutrients contained. It stimulates the appetite, aids digestion, and improves the general health and thrift of the animal. It has been shown that anything that will contribute to this result will at the same time tend to the production of firm bacon. The most profitable results at all stations were obtained by feeding all the grain the pigs would eat in addition to the alfalfa. Larger gains for a given quantity of feed consumed were obtained by feeding a limited grain ration and compelling the pigs to eat more of the alfalfa, but much more rapid gains and better general thrift of the pigs getting a full grain ration in addition to the alfalfa was found to yield a large net profit, and to be more satisfactory in every way.

The alfalfa was fed dry, either whole or cut into chaff, and separate from the meal. Better results are obtained in this way than by mixing with the meal and thus forcing the pigs to consume an undue amount of it.

RAPE.

All things considered, rape is perhaps the most valuable crop for summer roughage. Hogs soon become very fond of it, and if the rape is supplemented with a liberal grain ration, they will make very cheap and satisfactory gains. Like all other bulky forage crops its only value is as a supplement to a grain ration; hogs will not make satisfactory gains on rape pasture alone.

In experiments at Ottawa and at Guelph, rape has proved itself not only to be economical, but also to be conducive to the production of bacon of the highest quality.

Prof. Carlyle, of the Wisconsin station, conducted a series of experiments to test the value of rape in swine feeding. In one of these experiments two lots of 17 pigs each were fed as follows:—

Lot 1 was fed corn meal and shorts *ad libitum*, while lot 2 was hurdled on rape and fed the same grain in addition. At the beginning of the trial the pigs averaged 59 lbs. The average daily gain without rape was ·85 lbs., and with rape 1·06 lbs. The grain consumed per 100 lbs. gain by the lot without rape was 437 lbs., by the lot hurdled on rape 420 lbs. The cost per hundred pounds of gain with rape was $2.73, without rape $3.36. Prof. Carlyle concludes: 'Pigs are more thrifty, have better appetites, and make correspondingly greater gains when pastured on rape pasture in conjunction with a grain ration, than when fed on grain alone. Rape is the most satisfactory and cheapest green feed for swine that we have fed.'

Prof. Craig, late of the Iowa station, found as a result of two years' experiments that an average crop of one acre of rape is equivalent to 2,600 lbs. of a grain mixture consisting of two-thirds corn and one-third shorts.

ROOTS.

Prof. Day, of the Ontario Agricultural College, conducted an experiment in 1901 to determine the value of roots when fed in conjunction with a grain ration. Four groups of pigs were fed as follows:—

Groups.	Total Weight, Oct. 23.	Total Weight, May 7.	Average daily gain per hog.
	lbs.	lbs.	lbs.
Experiment A—			
Group I —5 hogs; barley and middlings	169	670	·639
Group II—4 hogs: barley, middlings and roots	163	840	·857
Experiment B—			
Group III—5 hogs; corn and middlings	276	940	·677
Group IV—5 hogs; corn, middlings and roots	276	1,020	·737

In experiment A, 319 lbs., and in experiment B, 534 lbs. of roots effected a saving of 100 lbs. meal. These, as Prof. Day remarks, are abnormally high values for roots; but the experiment illustrated very well the value of roots when fed in limited quantities. In this experiment the groups getting roots were fed equal parts by weight of roots and grains. It was found that the hogs getting roots made large daily gains, and that the tendency was to growth rather than to fatten. It was necessary at the close of the experiment to reduce the amount of roots in order to get the pigs fat enough.

The pigs receiving roots not only made larger and more economical gains, but also produced a finer quality of bacon than the groups fed grain alone.

In Denmark one pound of barley is regarded to be equal to from six to eight pounds of mangels.

The chief value of roots, like that of rape, clover and alfalfa, lies in their effect on the digestive system. They keep the animals more thrifty, sharpen their appetites, and increase their digestive capacity. It is worthy of note that in every experiment in which any one of the above forage crops was added to a full grain ration, the pigs made more rapid and cheaper gains than when fed on grain alone, and in these experiments in which the quality of the product is reported, it was in every case improved by the addition to the ration of one or another of the foods mentioned.

Of the various root crops, mangels and sugar beets seem to be better adapted to swine feeding than turnips. They are more palatable, and the pigs seem to relish

them better and eat them more readily. Sugar beets have an additional advantage in that they are better keepers than either mangels or turnips, and will thus furnish a supply of succulent food during the month of May and the early part of June, when not much else is available.

POTATOES.

Prof. Henry, of the Wisconsin station, fed cooked potatoes with corn meal to one lot of pigs and a full corn meal ration to a corresponding lot, and found that 440 lbs. of corn meal fed alone produced 100 lbs. of gain, and that 262 lbs. of corn meal together with 744 lbs. of cooked potatoes produced the same gain. Thus 441 lbs. of potatoes effected a saving of 100 lbs. of corn meal.

If potatoes were fed in conjunction with, say, pea meal or some other substance rich in muscle forming elements they would probably make a better showing. Corn is relatively poor in muscle formers and rich in fat and heat producing elements, and potatoes are doubly so. To add potatoes, therefore, to a corn meal ration is to intensify the evil by widening a nutritive ratio that is already too wide.

The Danes found 400 lbs. of potatoes cooked and fed with skim milk equal to 100 lbs. of grain fed with a similar quantity of skim milk, and found that the quality of the pork produced from potatoes and skim milk was excellent.

Potatoes should in all cases be cooked for pigs. If fed raw they are very hard to digest and of comparatively small feeding value. The water in which they are boiled should be poured off, as it contains substances prejudicial to health. The feeding value of potatoes consists almost wholly in the large amount of starch that they contain. They are therefore an extremely one-sided food, and should be supplemented with some food stuff rich in muscle formers. For this purpose nothing is better than pea meal, and if some skim milk or buttermilk can be added to the ration, very satisfactory results will be obtained.

DAIRY BY-PRODUCTS.

So valuable are the by-products of the dairy, viz.: skim milk, buttermilk and whey, that they are regarded by many farmers as indispensable in the rearing of young pigs, and it must be acknowledged that, although many feeders are rearing hogs profitably without these foods, much better and cheaper results are possible when a limited amount of milk can be added to the ration. This is especially true in the case of pigs only recently weaned. Milk, being rich in ash and protein, is peculiarly adapted to the building up of the muscles and bony framework of growing animals.

Better results are obtained from skim milk or buttermilk when fed in conjunction with some cereal rich in starch, such as corn or barley, than when fed with other meals too rich in protein, such as gluten meal or pea meal. At the Cornell station cheaper gains were obtained from corn meal at $14 per ton than from gluten meal at $12 per ton when each was fed in conjunction with skim milk. It has also been found that milk is most valuable when fed in small quantities, viz., from 3 to 6 lbs. of milk for each pound of grain fed. Prof. Robertson found that:—

When feeding 2 lbs. of milk per head per day, 163 lbs. of milk effected a saving of 100 lbs. grain.

When feeding 3 lbs. milk per head per day 323 lbs. milk effected a saving of 100 lbs. grain.

When feeding 5·4 lbs. milk per head per day, 533 lbs. milk effected a saving of 100 lbs. grain.

When feeding 15·7 lbs. milk per head per day, 734 lbs. milk effected a saving of 100 lbs. grain.

When feeding 17·1 lbs. milk per head per day, 882 lbs. milk effected a saving of 100 lbs. grain.

As a result of a very exhaustive experiment conducted at the Wisconsin station under the direction of Prof. Henry it was found that:—

When feeding 1 lb. corn meal with from 1 to 3 lbs. separator skim milk, 327 lbs. skim milk saves 100 lbs. meal.

When feeding 1 lb. corn meal with from 3 to 5 lbs. separator skim milk, 446 lbs. skim milk saves 100 lbs. meal.

When feeding 1 lb. corn meal with from 5 to 7 lbs. separator skim milk, 572 lbs. skim milk saves 100 lbs. meal.

When feeding 1 lb. corn meal with from 7 to 9 lbs. separator skim milk, 823 lbs. skim milk saves 100 lbs. meal.

Average of all, 542 lbs. skim milk equals 100 lbs. meal.

Value of skim milk when fed in combination with corn at varying prices and in different quantities:—

Value of corn per ton.	Value of skim milk per 100 lbs. when fed in the following quantities.			
	1 to 3 lbs. to 1 lb. corn.	3 to 5 lbs. to 1 lb. corn.	5 to 7 lbs. to 1 lb. corn.	7 to 9 lbs. to 1 lb. corn.
$16.00	24c.	17.6c.	14.0c.	14.5c.
$20.00	30c.	22.0c.	17.4c.	18.0c.
$24.00	36c.	26.4c.	20.8c.	21.6c.

When mixed grains are worth $1 per cwt. skim milk fed at the following quantities per day is worth as follows per cwt.:—

2	lbs. per day—	54c.	per cwt.
3	"	—31c.	"
5.4	"	—18.6c.	"
15.7	"	—13.6c.	"
17.1	"	—11.33c.	"

These results are corroborated by the findings of the Cornell, and also of the Utah station. Danish investigators also found that the relative gain obtained from milk increased as the quantity fed was decreased. As a result of their experiments they conclude that under ordinary circumstances 600 lbs. of milk may be considered equivalent to 100 lbs. of rye or barley meal.

Buttermilk has a very similar feeding value to skim milk, varying of course with the amount of water added.

Whey also has a very high feeding value when fed in conjunction with a liberal grain ration. Prof. Day found that when feeding about 2 lbs. of whey to 1 lb. of grain, from 750 to 800 lbs. of whey effected a saving of 100 lbs. of grain. Very similar results were obtained at Wisconsin.

The results of experiments conducted at Guelph and at Vermont to test the relative values of sweet skim milk and whey as compared with the same feeds slightly sour, seem to indicate that a little better results are obtained by souring.

It would seem that the acids resulting from a mild fermentation of milk have a beneficial effect on the digestion and general health of the animal to which it is fed, and that this medicinal effect is, if anything, rather more than a compensation for the milk and sugar used up during the process of fermentation. Care must be taken, however, not to allow the fermentation to proceed too far. If the barrels or tanks in which skim milk or whey is kept are allowed to become offensively foul, deleterious ferments will be formed and good results cannot reasonably be expected.

FEEDING SKIM MILK.

An investigation of the methods of practical swine raisers in feeding skim milk to hogs has revealed valuable lessons upon the subject. Many of the most successful hog raisers feed their young pigs very largely upon skim milk, adding to it a small proportion of shorts or finely ground oats or barley with the coarse hulls removed. For three or four weeks after the pigs are weaned, at seven to eight weeks old, skim milk is fed with solid food mixed with it at the rate of about 12 to 15 pounds of milk to one pound of grain. This mixture, fed sweet and warm, provides a moderate change from the sow's milk, and being palatable, nourishing and easily digested, produces thrift and highly profitable gains. As judgment dictates, the grain portion of the ration should be increased until the pigs are about three months old and thriving well, when a cheaper ration, such as pasture or green fodder in summer and roots in winter, may be gradually substituted for a part of the milk and the grain.

On many well managed hog-raising farms pigs from 10 to 12 weeks old are turned on pasture of clover or grass when they receive little more than skim milk in addition to what they graze and gather while rooting up the sod. Pigs reared in this way, not only put on weight rapidly and cheaply, but they lay the foundation for continuous profitable feeding, and whether for breeding purposes or the bacon market, they fulfil the requirements exactly. They develop strong frames and lengthy muscular bodies, providing an excellent medium for converting a large amount of cheap material, that in many cases would be wasted, into a highly valuable product.

It is important to avoid sudden changes in the condition of the milk for feeding. For young pigs it should at all times be fed sweet and warm. For older animals it appears to make little difference whether it is given sweet or slightly sour, but it is highly important to avoid changing from sweet to sour, as such variations are usually attended by an interference with the working powers of the digestive machinery, which should be kept in the best possible order for the maximum of gains from the food consumed. As hogs approach maturity, milk feeding is less important because the animals are then able to digest and appropriate coarser foods. Even then, however, skim milk is valuable when wisely fed beyond the belief of many hog raisers.

FEEDING WHEY.

Valuable lessons upon the food value of whey in hog feeding and methods of using this dairy by-product have been deducted from the experience of cheese factory patrons who for many years have continued to feed off large numbers of hogs. These lessons are presented for the benefit of patrons in districts where whey is allowed to waste in large quantities for want of hogs to consume it.

In some of the older dairying sections of Ontario the production of cheese and of bacon hogs are correspondingly large. It has been learned by years of experience that whey fed intelligently has a high feeding value, and that hogs fed upon it produce a high quality of bacon.

In some districts the whey is fed at points adjacent to the factories. The factory owners buy the hogs and allow the patrons a certain consideration in making the cheese for the whey. The hogs are usually purchased weighing from 75 to 100 pounds, and are fed until ready for market weighing about 200 pounds. The most successful feeders feed the whey while still sweet and warm. Usually one feed per day consists of whey alone, and for the other two feeds shorts, low grade flour or finely ground grain is added. At the commencement the hogs get from 1½ to 2 pounds per head per day of grain. This is increased very slowly until about 8 pounds per day is reached in the last stages of finishing. An effort is made to keep sufficient hogs to consume all the whey of the factory without having to give other liquid as drink.

Where hogs are fed in this way it is highly important that the pen be located at a sufficient distance from the factory to prevent offensive odours reaching the

factory. It is also advisable that the direction from the pen or yards to the factory be opposite to that of the prevailing winds during the summer season. Even when these precautions are observed careful attention to cleanliness of pens and yards have to be constantly observed.

In other districts the whey is returned and fed upon the individual farms of the patrons. When the whey is thus returned it is very important that the danger of contaminating the milk supply be guarded against, either by using separate cans for the whey or failing that to have the cans emptied and thoroughly washed, scalded and exposed to pure air immediately upon their return to the farms. Whey, to reach the farms in good feeding condition, should be scalded and come out of storage tanks at the factory, that are emptied frequently and kept clean. Many factories have two tanks which are emptied and cleansed on alternate days.

On many farms hogs are fed for several months during the summer upon little else than whey and pasture, or green food carried to them. It is usually preferred, however, to give a light grain ration as well, increasing it as judgment dictates, until the hogs are sold.

A very satisfactory method of feeding whey to hogs is to soak shorts or finely ground chop in it and feed three times a day. Shorts forms the best grain part of the ration until the hogs weigh about 80 pounds; after that ground barley, corn and oats, with the coarsest of the hulls removed, answers well. Many hundred-acre dairy farmers in Ontario sell from $500 to $800 worth of hogs annually and purchase comparatively little grain. These farmers sell practically no grain in its raw state, with the result that their land is becoming more productive year by year, which enables them to keep more cows and feed them better and thus secure an increasing annual revenue from their farms. Farmers who send milk to a cheese factory and receive no revenue for the whey either directly or from the hogs fed upon it on their own farms are allowing a large amount of profits that belongs to them to slip past year by year.

XI.—PREPARATION OF FEED.

Much difference of opinion exists as to the relative economy of feeding grain ground or unground, soaked or dry, cooked or raw, &c., and because of the large variety of circumstances that influence more or less the results, it is impossible to say that any one method of feeding is essentially the best. The nature of the feed, the age of the pigs, the cost of grinding or cooking, the price of labour, the season of the year, the nature of the buildings in which the pigs are being fed,—all of these factors influence the relative results to be obtained from contrasted methods of feeding, and must be taken into consideration in determining the best system to adopt on any given farm.

Heretofore the most common practice among Canadian feeders has been to grind the grain as finely as possible, soak it from 12 to 24 hours, and feed it as a slightly fermented slop; but the trend of opinion now among our most experienced feeders seems to be towards dry feeding, giving the necessary drink either at a separate trough or at another time.

SLOP FEEDING.

One of the greatest objections to slop feeding is that in the hands of unskilful feeders there is a danger of making the slop too thin and in this way compelling the pigs to take much more water than is necessary in order to get sufficient nourishment. This mistake is a serious one, especially in cold weather. Water has been said to be fattening, but 'that depends'; to deprive an animal of the necessary water to satisfy the normal requirements of its system is to impede the fattening process; but on the other hand to compel the hog to take into his digestive system a surplus of water on a cold day and in a cold pen, is certainly not conducive to rapid gains. Another disadvantage of slop feeding is that the barrels or tanks in which the food is soaked are sometimes allowed to become rancid, and ferments are engendered that, if not prejudicial to the health of the animal, at least destroy the nutritive value of the food given. Certain substances, such as milk and whey, appear to be improved by moderate souring, but if the fermentation be allowed to proceed too far products are formed, which if not absolutely harmful, are at least of no feeding value. The products of fermentation vary with the substances fermented. It, therefore, does not follow that because milk is improved by slight fermentation, similarly good results will be obtained from the fermentation of grain.

DRY FEEDING.

One of the disadvantages of dry feeding is that hogs are apt to nose a quantity of the meal out of the trough, which of course means a certain amount of waste. This may be largely overcome by the use of large flat bottomed troughs with square sides. The longer and wider the trough the better, so the meal may be spread as thinly as possible on the bottom. This prevents the hog from gulping his food in large mouthfuls and afterwards slobbering it about the pen. In the opinion of the writer the best method of feeding is that adopted by some of the largest American feeders, viz.: to provide a dry, clean, elevated feeding floor, on which the grain or meal is scattered and the hogs compelled to pick it up in small quantities. By this method all waste is obviated, the food is better masticated and mixed with the saliva, and better digestion and greater gains may be reasonably expected. The water should be supplied in a separate trough, or, better still, by means of a drinking fountain attached to a barrel.

In bulletin No. 33 of the Central Experimental Farm, J. H. Grisdale, Agriculturist, sums up a series of experiments in the following table, which contains some

very interesting and valuable data on the matter of whole vs. ground grain, and wet vs. dry feeding.

Experiment Feed.	How prepared.	No. of swine.	Av. wt. at start.	Av. wt. at finish.	Aver. net gain.	No d'ys fed.	Aver. daily gain.	Aver. amt. feed eaten.	Av. amt feed per 100 lbs. gain.
			Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
1. Peas, barley and rye	Whole, soaked 48 hrs.	5	69	156	87	115	73	386	445
2. " "	Ground, soaked 12 hrs.	5	69	173	104	119	87	455	436
3. Oats, barley, peas and bran	Whole, dry	4	67	175	108	119	90	441	408
4. " " "	Ground, dry	4	69	195	126	119	1 06	450	356
5. " " "	Whole, soaked, 30 hrs.	4	66	171	105	119	88	409	388
6. " " "	Ground, soaked 30 hrs.	4	66	190	124	119	1 04	467	376
7. Oats, peas and barley	Whole, dry	4	103	185	82	76	1 08	307	360
8. " " "	Ground, dry	4	101	190	89	76	1 17	307	343

When whole grain was fed, soaking for 30 hours effected a saving of nearly 5 per cent (see exps. 3 and 5). When ground grain was fed soaking resulted in a loss of nearly 6 per cent (see exps. 4 and 6).

Prof. Day of the Ontario Agricultural College found that soaking the meal resulted in a loss of something over 8 per cent.* The pigs getting a ration of wheat and barley meal soaked consumed 489 lbs. of grain per 100 lbs. of gain, while those getting the same ration dry made a gain of 100 lbs. from 452 lbs. of grain fed.†

At the Indiana station four lots of three pigs each were fed on a ration consisting of equal parts of corn meal and shorts.

Lot No. 1 received the meal dry.

Lot No. 2 received the meal mixed with its own weight of water.

Lot No. 3 received the meal mixed with twice its own weight of water.

Lot No. 4 received the meal mixed with three times its own weight of water.

In addition each lot received all the water they could drink.

Lot.	Ration.	Daily gain, lbs.	Pounds of grain consumed per 100 lbs. of gain.
1	Meal, dry	4¼	
2	Meal and water 1–1	4¼	359
3	" 1–2	4¼	380
4	" 1–3	4¼	374
			375

Averaging the results of lots 2, 3 and 4, and comparing with lot 1, we find that soaking resulted in a loss of nearly 5 per cent.

Taken on the whole, it is quite evident that under ordinary conditions it is profitable to grind the grain for pigs. The only likely exception is in the case of peas which, if soaked until they are soft may be fed whole with very satisfactory results. Some good feeders give their pigs a feed once a day of peas in the straw and allow the pigs to thresh them for themselves. So far as the writer has been able to discover no experimental work has been done to determine the economy of this method of feeding peas, but, if the straw is not wanted for any other purpose than for bedding, the practice has much to commend it. It provides an agreeable change which the hogs appear to relish very much, and it has been pretty well established that anything which contributes to the pleasure of an animal while feeding increases the activities of the digestive system; the pigs are compelled to eat the grain slowly and mastication is therefore more thorough; they are induced to take

* See report 1900. Ontario Agricultural College.
† See Bulletin 86. Ontario Agricultural College.

more exercise, and there is a considerable saving of expense for threshing and grinding.

COOKING.

The advisability of cooking or steaming food for swine was for many years the subject of much controversy; many of the most successful feeders both in Canada and in the United States held widely different opinion, and differed quite as widely in their practice. During the past decade, however, the process, unless in the case of potatoes, has fallen very largely into disuse. It has been pretty conclusively proven that, unless under exceptional circumstances, better results are obtained from a given amount of grain or roots given raw than from a similar amount after it has been cooked.

It was formerly believed, and is still by many feeders, that the process of cooking increases the digestibility of the food; but it has been shown that as a rule the contrary is true, especially in the case of food rich in protein. Extensive experiments conducted both in Germany and in America have been remarkably uniform in their results, and unite to show that protein is less digestible after exposure to high temperature. The digestibility of starch is to some extent increased by cooking, and for this reason potatoes should always be cooked for hog feeding. It must be conceded that some feed stuffs such as turnips and pumpkins are made much more acceptable to pigs by cooking, and will therefore in some cases give better results cooked than raw; there is also some advantage in giving feed warm during cold weather, but both German and American investigators are practically unanimous in condemning the practice of cooking feeds, other than potatoes, that are palatable in their raw state, because it reduces the digestibility of the protein; a loss for which, in the absence of any increased palatability, it offers no compensating advantages. It is now generally conceded by those who have given the feeding of potatoes a fair study, that these tubers fed raw have very little nutritive value, but when cooked they are worth about one-quarter as much as mixed grains.

FEEDING EXPERIMENTS.

At the Kansas station, Prof. Shelton fed two lots of pigs on cooked corn and uncooked corn respectively for 90 days. The lot on cooked corn made an average gain per hog of 104 lbs. during that period, while the lot on raw corn made an average gain of 151 lbs.; the lot fed on cooked corn consumed 750 lbs. of grain per 100 lbs. of gain, while the lot receiving uncooked corn consumed only 630 lbs. of grain per 100 lbs. of increase. These figures show a loss of nearly 20 per cent by cooking. These were very heavy pigs at the commencement of the experiment, which accounts for the unusually large amounts of grain consumed in both cases per 100 lbs. of gain.

The Iowa station compared dry corn meal with cooked corn meal for a period of four months, with the following results:—The lot on dry corn meal made an average gain of 202 lbs., while the average gain on cooked meal was only 142 lbs. The food consumed per 100 lbs of gain was 417 lbs. of dry meal as compared with 592 lbs. of cooked meal. Here was a loss of nearly 40 per cent by cooking.

Raw and cooked peas were compared at the Ontario Agricultural College in two experiments. Averaging the two experiments, 100 lbs. of gain was obtained from 422 lbs. of raw peas, and from 497 lbs. of cooked peas.

Experiments were conducted for nine successive years at the Maine station, in which, without a single exception, better results were obtained from the uncooked grains. Similar results were obtained at Wisconsin, Ohio and other stations; all of which go to show that the cooking of grain results in a loss in feeding value in addition to the expense of labour and of cooking.

WHOLE GRAIN *VS.* MEAL.

Referring again to the table given on page 37, note that in experiments 3 and 4, in which the pigs were quite young at the commencement of the experiment, grinding resulted in a saving of a little over 10 per cent, while in experiments 7 and 8, in which the pigs weighed over 100 lbs. at the commencement of the experiment, the grain saved by grinding was scarcely 5 per cent. In experiments 5 and 6, in which the grain was soaked in both cases the saving effected by grinding was about 4 per cent. It will be noticed that in experiments 1 and 2, in which the ration contained no oats, grinding effected a saving of only 2 per cent. J. H. Grisdale, Agriculturist, C.E.F., Ottawa, observes that 'whenever whole oats are fed a considerable quantity are undigested, due probably to their thick, fibrous hulls.'

Prof. Henry, of the Wisconsin station, in his report for 1902, sums up a series of experiments to determine the relative value of whole corn and corn meal.

Report.	No. of pigs in each lot.	Aver. wt. at beginning	Per cent saved or lost.
		Lbs.	
1895 ..		3.6	
1896....	9-10	224	8.0 saved by grinding.
			17.6 "
1897....	9	211	11.0 "
1897....	7	190	9.0 lost by grinding.
1898..	8	185	5.4 saved by grinding
1898....	9	184	8.4 "
1899....	19	186	2.0 lost by grinding.
1900....	14	175	15.0 saved by grinding.
1901 ...	12	146	6.0 "
1902 ...	6	71	1.0 lost by grinding.
1902 ...	6	80	3.0 saved by grinding.
1902 ...	6	133	8.0 "

XII.—COMPOSITION OF THE LEADING FOODS USED IN SWINE FEEDING.

The subjoined table of composition of foods was compiled from data taken from Prof. Henry's 'Feeds and Feeding.' The table does not show the total amount of each of the constituents present; it shows the total amount of water and of ash and the amount digestible by cattle, of each of the other constituents. Comparatively few digestion experiments have been conducted with swine; it is, therefore, impossible, from any data at present available, to compile a satisfactory table showing the amount digestible by swine of each of the nutrients contained in a number of feeding stuffs. Enough work has been done with swine to show that the digestion by swine of grains and other concentrated foods containing only a small amount of crude fibre, is very similar to the digestion of the same foods by cattle or sheep. The difference is so slight that it does not impair the usefulness of a table compiled from digestion co-efficients as determined with cattle.

TABLE OF COMPOSITION OF FEEDING STUFFS.

Showing the number of pounds of digestible Nutrients contained in 100 lbs. of the Feedstuffs named.

Feed-stuff.	Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive ratio.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
Corn	10.9	1.5	7.9	66.7	4 3	1 : 10
Gluten meal	8.2	.9	25.8	43.3	11.	1 : 3
Barley	10.9	2.4	8.7	65.6	1.6	1 : 8
Oats	11	3	9.2	47.3	4.2	1 : 6
Rye	11.6	1.9	9.9	67.6	1.1	1 : 7
Peas	10.5	2.6	16.8	51 8	.7	1 : 3
Buckwheat	12.6	2	7.7	49.2	1.3	1 : 7
Wheat	10.5	1.8	10.2	69.2	1.7	1 : 7
Wheat bran	11.9	5.8	12.2	39.2	2.7	1 : 4
Wheat middlings	10	3.8	12.8	58	3.4	1 : 5
Linseed meal (new process)	10	5.2	28.2	40.1	2.8	1 : 2
Clover (green	70 8	2.1	2 9	14.8	.7	1 : 6
Alfalfa	71.8	2.7	3.9	12.7	.5	1 : 4
Rape	84.5	2	1.5	8.1	.2	1 : 6
Sugar beets	86.5	.9	1.1	10.2	.1	1 : 9
Mangels	90.9	1.1	1.1	5.4	.1	1 : 5
Turnips	90.5	.8	1	8.1	.2	1 : 9
Artichokes	79.5	1	2	16 8	.3	1 : 9
Potatoes	78 9	1	.9	16.3	.1	1 : 18
Skim milk	90 6	.7	2 9	5.2	.3	1 : 2
Buttermilk	90.1	.7	3.9	4	1.1	1 : 2
Whey	93.8	.4	.8	4.7	.3	1 : 7

EXPLANATION OF TERMS USED.

ASH.

Ash includes all the mineral constituents of the food, which consist mainly of carbonates and phosphates of potash, lime, magnesia and soda. In animal nutrition these mineral constituents of the food are essential to the nourishment and growth of the bony framework. Bone formation cannot take place in the absence of phosphoric acid and lime, hence the great importance of ash in the food of young, growing animals. The well known value of such foods as milk, oats and bran in the feeding of young stock may be quite largely attributed to their richness in ash.

The mineral constituents of the food are important not only to the growing, but also to the fully developed animal. Some of them are essential to the operation of the digestive juices, and even mature animals will languish and finally die if wholly deprived of some of these ash ingredients. They are especially important in the nutrition of nursing animals because of the large amount of ash secreted in the milk.

PROTEIN.

Protein includes all the nitrogenous compounds of the ration. A well known example of almost pure protein is found in the white of an egg. Protein is the only constituent of the food from which flesh (lean meat or muscle) can be formed; it is also essential in the formation of all the other nitrogenous portions of the body, such as the tendons and ligaments, the hoofs, skin, hair, &c. It is, therefore, not only important but essential that the food of growing animals, in particular, contains a sufficient quantity of protein. The nutritive functions of the nitrogenous compounds of the food are not limited to the formation of similar compounds in the body; they are also used in the production of animal heat, or energy, and in the formation of fat.

CARBOHYDRATES.

Under this heading are grouped a number of substances, the most important of which are starch and sugar, but including also some other compounds closely allied to starch. Their principal nutritive function is the production of heat and energy. It was for a long time believed by animal chemists that this was their only function, but it has now been pretty well established that animal fat also is formed from the carbohydrates.

FAT.

Fat also includes, with the vegetable fats and oils, a number of other substances very similar to the fats in their general character. These substances (sometimes called ether extract) are used in the process of animal nutrition in much the same way as the carbohydrates, viz., the production of heat and energy and the formation of fat. Fat has a greater value as a heat and force producer than any other constituent of the food, and is believed to be about 2¼ times as valuable for the purpose as the carbohydrates. It is believed that some of the vegetable fats are deposited in the body as animal fat without any considerable change during the process of digestion.

NUTRITIVE RATIO.

By this term is meant the proportion of digestible protein compared with the digestible carbonhydrates and fat. The fat is multiplied by 2·4 to determine its equivalent in carbohydrates, and the amount thus obtained is added to the carbohydrates. Thus, in calculating the nutritive ratio of corn from the analysis given in the table, the fat multiplied by 2·4 and added to the carbohydrates bring the latter up to 77·02. The ratio of the protein to the carbohydrates, therefore, is as 7·9 is to 77·02, or as 1 is to 9·7, or practically 1:10.

This is regarded as a wide nutritive ratio, while 1·3, as in the case of peas, is spoken of as a narrow nutritive ratio. A balanced ration is one containing protein (flesh former) and carbonhydrates (heat and fat formers) in just the right proportions to meet the requirements of the animal to which it is fed. It will thus be seen that a balanced ration cannot be calculated with mathematical exactness and that it will vary with the class of animal to which it is fed. The requirements of a growing animal differ from those of a mature animal; therefore, a balanced ration for the one would not be a balanced ration for the other. It may be laid down as a safe rule, sound in principle and borne out by the experience of the best feeders, that a fairly narrow ration (say 1·5) will give the best results with growing stock, while a wider ration (1·7, not exceeding 1·10) is more economical for mature, fattening animals.

XIII.—GESTATION TABLE.

The period of gestation in swine is almost invariably 112 days, or 16 weeks. Occasionally an old sow will carry her litter for one or two days longer, and sometimes a young sow will farrow a few days earlier, but as a rule they are remarkably regular in gestation.

The following table is calculated on the basis of 112 days and is convenient for reference. Thus, in keeping a breeding record, which may be on a form similar to that appended as an illustration, if the sow Sally were mated with Conqueror on January 5, by consulting the table we see at a glance that she is due to farrow on April 27, which may be entered on the record at once without any troublesome calculations.

BREEDING RECORD.

Name of Sow.	Name of Boar.	Date of Service.	Due to Farrow.
Sally.	Conqueror.	January 5th.	April 27th.

Jan.	Mated.	April.	Due to Farrow.	May	Due to Farrow.	Mar.	Mated.	June.	Due to Farrow.	April	Mated	July.	Due to Foarow.	May.	Mated.	Aug.	Due to Farrow.	June.	Mated.	Sept.	Due to Farrow.	July.	Mated.	Oct.	Due to Farrow.	Aug.	Mated.	Nov.	Due to Farrow.	Sept.	Mated.	Dec.	Due to Farrow.	Oct.	Mated.	Jan.	Due to Farrow.	Nov.	Mated.	Feb.	Due to Farrow.	Dec.	Mated.	Mar.	Due to Farrow.
1	9	25	1	25	1	1	9	21	30	1	9	31	30	1	9	21	30	1	9	21	30	1	9	21	30	1	9	21	30	1	9	21	30	1	9	21	30	1	9	21	31	1	9	21
2	10	26	2	26	2	2	10	22	July. 1	2	10	Aug. 1	31	2	10	22	31	2	10	22	Oct. 1	2	10	22	Nov. 1	2	10	22	Dec. 1	2	10	22	31	2	10	22	31	2	10	22	Feb. 1	2	10	22	Mar. 1
3	11	27	3	27	3	3	11	23	31	3	11	2	Sept. 1	3	11	23	Nov. 1	3	11	23	31	3	11	23	2	3	11	23	2	3	11	23	Jan. 1	3	11	23	1	3	11	23	2	3	11	23	2
4	12	28	4	28	4	4	12	24	1	4	12	3	2	4	12	24	2	4	12	24	1	4	12	24	3	4	12	24	3	4	12	24	2	4	12	24	2	4	12	24	3	4	12	24	3
5	13	29	5	29	5	5	13	25	2	5	13	4	3	5	13	25	3	5	13	25	2	5	13	25	4	5	13	25	4	5	13	25	3	5	13	25	3	5	13	25	4	5	13	25	4
6	14	30	6	30	6	6	14	26	3	6	14	5	4	6	14	26	4	6	14	26	3	6	14	26	5	6	14	26	5	6	14	26	4	6	14	26	4	6	14	26	5	6	14	26	5
7	15	May 1	7	31	7	7	15	27	4	7	15	6	5	7	15	27	5	7	15	27	4	7	15	27	6	7	15	27	6	7	15	27	5	7	15	27	5	7	15	27	6	7	15	27	6
8	16	2	8	June. 1	8	8	16	28	5	8	16	7	6	8	16	28	6	8	16	28	5	8	16	28	7	8	16	28	7	8	16	28	6	8	16	28	6	8	16	28	7	8	16	28	7
9	17	3	9	2	9	9	17	29	6	9	17	8	7	9	17	29	7	9	17	29	6	9	17	29	8	9	17	29	8	9	17	29	7	9	17	29	7	9	17	29	8	9	17	29	8
10	18	4	10	3	10	10	18	30	7	10	18	9	8	10	18	30	8	10	18	30	7	10	18	30	9	10	18	30	9	10	18	30	8	10	18	30	8	10	18	30	9	10	18	30	9
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XIV.—THE PRESENT AND FUTURE OF THE CANADIAN BACON INDUSTRY.

While each of the provinces of Canada contributes hogs to the bacon industry, from 75 to 85 per cent of the annual pack comes from Ontario farms. The hogs raised in Quebec up to quite recently have been consumed largely within the province. An effort has been made by the Dominion Department of Agriculture to improve and increase the hog stock of Quebec by introducing, by a system of auction sales, hogs suitable to the requirements of the export trade. In the maritime provinces the raising of hogs is not as extensively carried on as it should be. In fact, only in the dairying sections are any produced for packing. The farmers of Prince Edward Island are doing more proportionately in this regard than the other Atlantic provinces, but the output of hogs for 1906 was considerably less than during 1904, and only a comparatively small proportion reached the export trade. In the west there may be important developments within the next few years. Damaged wheat, cheap coarse grains and the influx of United States farmers all point to increased hog raising, and the consequent establishment of packing centres at western points.

The production of hogs made marked progress in Canada during the fifteen years ending 1905. Since then considerable decrease in production has taken place. In 1890 there were about 200,000 hogs marketed; in 1904 1,700,000; while in 1906 the number was 1,300,000. In 1890 there were but two packing houses in the export trade, with a weekly capacity of perhaps 3,000; in 1906 19 packing houses, with a capacity of at least 65,000 a week, were in operation. According to the statements of the managers of these various houses at no time have these institutions been taxed to cope with the hogs offering. In fact, the supply has not exceeded from 20,000 to 35,000 hogs weekly, according to the season of the year, so that conditions have favoured an active competition for the hogs.

The output of Canadian packing houses is largely exported. Eighty-five per cent of the total pack finds its way to the English market. Great Britain's weekly supply of bacon during the year comes from the various sources as follows:—From the United States the product of about 70,000 hogs; Denmark, about 35,000; Canada, about 30,000; Ireland, about 10,000, and continental Europe the product of about 5,000 hogs per week.

It will thus be seen that Canadian bacon is about 20 per cent of the total quantity imported by Great Britain. This, considering the importance of our agricultural and dairying industries, can scarcely be regarded as a satisfactory percentage. Moreover, we are scarcely holding our position in relation to other countries. Denmark has improved her position during the last seven years by about 40 per cent, while during that time Canadian exports have been practically stationary.

Numerous causes may be cited for the difference in the progress made in hog raising by Canada and Denmark. In the latter country a thorough system of co-operation is in progress not only in a united endeavour to produce hogs of only the desired weights and form, but also to keep up a regular supply throughout the year and from year to year. In Canada it is quite different. While the improvement in the quality of hogs produced has for a number of years been very general, it has not been nearly so pronounced as it would have been with greater co-operation. Nor is the supply of hogs in Canada as regular as in Denmark, either throughout the year or from season to season. Raising hogs in fair quantity when prices are high, going out of them, in whole or in part, when prices are low, too many farmers deny themselves the advantage of a good average price, and make impossible a steady inroad into the English bacon market, which must have quantity—and steady quantity at that—to back it up. Such spasmodic support spells ruin to the Canadian bacon trade, because the

English customer is, in the main, a conservative and consistent purchaser of one brand of bacon. If his supply from a certain quarter falls short he seeks another more regular source of supply, and as a rule depends upon it as long as it continues to be satisfactory.

The reputation of Canadian bacon is steadily improving on the English market. We are approaching nearer to Danish prices than ever before, and Canadian bacon generally has probably never had a better reputation. The great lack is quantity. During these periods of ebb we lose the business purchased during previous periods of high tide in deliveries. This all means waste of money when at a later period, under heavier delivery, we have to buy back the business once again.

During the past two seasons several features have retarded the extension of our bacon trade. With fair to good prices throughout the season the packing houses have not had sufficient hogs of any sort to keep their plants going at anything like their full capacity. This is attributed to the growing prosperity of the farming class, together with a scarcity of farm help.

An unfavourable feature of the situation for several years was a tendency on the part of farmers to market their hogs in an unfinished condition. Sometimes from lack of grain, oftener through fear of taking lower prices later, hogs were sold in such condition, or at such weights, that the whole trade suffered from a surfeit of light or unfinished product. This tendency is becoming less pronounced in Ontario, as hogs in that province are being better finished now than in the past, but in the province of Quebec, where too little coarse grain is grown, too many hogs are marketed in an unfinished condition.

The bacon industry of Canada, worth some eighteen million dollars annually, is surely worthy of the earnest support of farmers. The chief weaknesses are the irregular supply and a failure in many sections to meet the requirements of the trade by not producing the type of hog called for. The difficulty regarding supply may be overcome by a closer study of the question of the production of winter and spring litters and the cheaper production of hogs at all seasons. The farmer who feeds his growing hogs and breeding stock in a close pen on an almost exclusive diet of grain is not going to continue to raise pork for the reason that he cannot make it profitable. He must use green crops, roots, dairy by-products and other refuse, and care for his animals in such a way that the very best returns will be received from the food given.

The most urgent need of the bacon industry is a steady, persistent support, begotten of the belief that year in and year out hog-raising pays when pursued along right lines. If this is done there are great possibilities for Canadian bacon. Because of distance from market and the demand for an exceedingly mild-cured article, Canadian bacon has not, up to the present time, sold on even terms with the best Irish or Danish brands, which are within a couple of days of the market. However, with improved cold storage facilities on steamships and at British ports, the difference in price between Canadian and the more popular European brands is gradually being overcome, and the finest Canadian is rapidly approaching the top price paid for bacon in Britain. Our bacon occupies a position some shillings per hundredweight better than American and with its growing popularity with the English consumer, it should be the bacon of the people in just the same way that Canadian cheese is the cheese of the people of Great Britain. That it may occupy this position, however, there must be, on the part of the farmers, persistent and increased rai-ing of hogs during periods of low prices as well as high; the hogs marketed must conform to market requirements as regards type, quality and weight, as described in the foregoing pages of this bulletin. To the extent that Canadian hog raisers comply with these conditions they do their part towards building up a very desirable and valuable trade with Great Britain and other countries looking for bacon of high quality; on the other hand, those who persist in raising hogs spasmodically or of poor type and disposing of them either too fat or too thin, are very effectively damaging the industry that is doing much for the prosperity of Canadian agriculture. The packers, too, must continue

to do their part in the careful curing and marketing of the product as will stea... build up its reputation for quality and uniformity, that its position in relation ... other brands on the English market may be gradually improved. If, in addit... relations of confidence are maintained between packer and farmer, through open d... ing and intelligent co-operation in the common problem, there is no reason why Ca... dian bacon should not become, like Canadian cheese, a prime necessity to the Briti... consumer.

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